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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 22
NOVEMBER 15, 1969

W69-09029 -- W69-09446

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 2, NUMBER 22
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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
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SELECTED WATER RESOURCES ABSTRACTS

02. WATER CYCLE

2A. General

HYDROLOGIC CYCLE OF NORTH AMERICA FORMULATED BY THE ANALYSIS OF WATER VAPOR TRANSPORT DATA,
Connecticut Univ., Storrs.
Gurbachan P. Malhotra.
Ph D Diss, Conn Univ, 1969. 159 p, 79 fig, 16 tab, 89 ref, 1 append.

Descriptors: *Hydrologic budget, *Hydrologic cycle, *Climatology, *Synoptic analysis, Water vapor, Precipitation (Atmospheric), Evapotranspiration, Runoff, Infiltration, Meteorology, Weather, Atmosphere, Atmospheric physics, Distribution patterns, Weather patterns.
Identifiers: North America, Water vapor transport, Flux divergence.

The atmospheric water vapor flux divergence is used to investigate the water balance of parts of North America for the period May 1, 1958 to Apr. 30, 1963. Data include mean monthly vertically integrated distribution of flux divergence and precipitable water, regional averages of runoff, and isohyetal averages of precipitation. The atmospheric data extend up to a height of 300 mb. The flux divergence and precipitable water were used to estimate the mean difference between precipitation and evapotranspiration. The total area of study is about 8.5 million km (3.3 million sq mi). The pattern of monthly evapotranspiration and storage computed from atmospheric data becomes questionable in areas smaller than 200,000 sq mi. This is due to systematic error, to the inadequacy of reporting, or the density of stations. The Thornthwaite method systematically gives higher values of the Summer evapotranspiration, lower values for Winter, lower values for storage in Fall, and higher values for storage in Spring, than vapor flux methods. Only the 12-month harmonic is significant at the 95% level. Generative processes for various types of data have been identified and coefficients worked out for formulating the models for these processes in particular cases. (Knapp-USGS)
W69-09154

EFFECT OF KARST ON THE MINIMAL RUNOFF OF THE PLAINS RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-09168

MINIMAL RUNOFFS OF TRANSBAIKALIAN RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-09169

ELECTRONIC MODELING METHOD OF CALCULATING STORMFLOW IN STEPPE AND FOREST-STEPPE AREAS OF EUROPEAN USSR (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
I. A. Shiklomanov.
Trudy Gos Gidrol Inst, Issue No 163, p 126-148, 1968. 23 p, 8 fig, 7 tab, 22 ref.

Descriptors: *Floods, *Storm runoff, *Forest soils, *Grasslands, *Electronics, *Mathematical models, Precipitation (Atmospheric), Hydrographs, Streamflow, Hydraulic structures, High water mark, Slopes, Water loss, Infiltration, Evaporation.
Identifiers: *USSR, Ukraine (European), Rainstorms.

On the basis of 4 gaging stations in the Ukraine, the hydrographs of rainstorm floods in small drainage areas were analyzed by using an electronic modeling apparatus. The analysis consisted of the calculations of maximum discharges of percent frequency using the Duhamel integral and experimental formulas developed by I. A. Shiklomanov (1966), M. Kleen and R. Andrews (1962), Z. P. Bogomazova et al. (1948), D. L. Soklovskiy (1959), and others. The use of electronic modeling for the computation of floods of small unstudied streamflows is considered to be entirely reliable. (Gabriel-USGS)
W69-09170

MEAN LONG-TERM WATER BALANCE OF MOUNTAIN WATERSHEDS BASED ON THE DATA OF TRANSCARPATHIAN GAGING STATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-09171

NORMAL ANNUAL PRECIPITATION IN THE WESTERN SIBERIAN PLAIN AND NORTHERN KAZAKHSTAN (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02B.
W69-09172

THE HYDROMETEROLOGICAL INTERPRETATION OF THE PRECIPITATION PATTERN,
Meteorologischer Dienst der Deutschen Demokratischen Republic, Berlin. Forschungsinstitut fuer Hydrometeorologie.
For primary bibliographic entry see Field 02B.
W69-09176

METHODOLOGY OF HYDROLOGIC MODEL BUILDING,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 07C.
W69-09182

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
Geological Survey, Menlo Park, Calif.
R. W. Lichty, D. R. Dawdy, and J. M. Bergmann.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol Publ No 81, p 356-367, 1968. 12 p, 6 fig, 2 tab, 10 ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Flood forecasting, *Mathematical models, Systems analysis, Digital computers, Computer programs, Streamflow forecasting, Parametric hydrology, Hydrograph analysis, Infiltration, Surface-groundwater relationships, Simulation analysis, Optimization.
Identifiers: *Rainfall-runoff models.

A simplified, mathematical model of the surface-runoff component of streamflow response to storm rainfall was developed and programmed for digital-computer solution. The model uses an infiltration component based on an equation by Philip to determine rainfall excess, which is transformed by a linear basin-response function to simulate the flood hydrograph. An objective-fitting procedure that emphasizes the simulation of peak-discharge rate was used to identify optimum model parameters in a pilot study of a 5-sq mi drainage basin in North Carolina. Split-sample fitting and testing showed that predictive capability varied for 3 samples of flood events. Results of simulation for 2 test samples of pre-1948 flood events showed reasonable correspondence between simulated and observed flood peaks. The post-1948 test sample showed wide scatter between simulated and observed flood peaks. The post-1948 test sample showed wide scatter between simulated and observed flood peaks. Sensitivity analysis of objective-function response to parameter incrementation showed that antecedent moisture accounting grossly controlled the results of optimization. (Knapp-USGS)
W69-09183

ADAPTION OF ELECTRONIC COMPUTER FOR IMPROVED METHOD OF MODELING SURFACE RUNOFF FROM RAINFALL FOR SMALL WATERSHEDS,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W69-09186

GROUNDWATER-STREAMFLOW SYSTEMS IN WILSON CREEK EXPERIMENTAL WATERSHED, MANITOBA,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering; and Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
R. W. Newbury, J. A. Cherry, and R. A. Cox.
Can J Earth Sci, Vol 6, No 4, Part 1, p 613-623, Aug 1969. 11 p, 11 fig, 11 ref.

Descriptors: *Surface-groundwater relationships, *Streamflow, *Groundwater movement, *Water chemistry, Water quality, Hydrographs, Rainfall-runoff relationships, Infiltration, Runoff, Overland flow, Hydrologic budget, Base flow, Climates, Topography, Demonstration watersheds.
Identifiers: *Canada, *Manitoba, Wilson Creek Experimental watershed, Geochemical hydrographs.

Preliminary studies of the groundwater-streamflow systems in the Wilson Creek Watershed in southwestern Manitoba indicate that the hydrochemical characteristics of the system may be used to identify the base flow component of storm runoff hydrographs and to determine the proportions of the base flow derived from in-basin and out-of-basin recharge areas. Groundwater flow was studied by using a network of piezometers. Flow net analysis indicated local recharge and subsurface outflow from the basin. Base flow contributes sulfate, bicarbonate, and calcium to stream water. Streams, springs, and surface waters were analyzed and the results are shown by chemical hydrographs. (Knapp-USGS)
W69-09237

EVALUATION OF DROUGHT PERIODS BY COMPUTER ANALYSIS: AN APPLICATION IN SOUTHERN ITALY,
State Hydrographic Service, Genoa (Italy); and Rari Univ. (Italy).
For primary bibliographic entry see Field 07C.
W69-09275

MODELLING OF HYDROLOGIC PROCESSES WITH THE AID OF ELECTRONIC COMPUTERS,
Hydrometeorological Centre, Moscow (USSR).
L. S. Kutchment, and V. I. Koren.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 616-624, 1968. 9 p, 2 fig, 11 ref.

Descriptors: *Computer models, *Runoff forecasting, *Rainfall-runoff relationships, Evaporation, Storage, Infiltration, Digital computers, Analog computers, Routing, Streamflow forecasting, Optimization.
Identifiers: Rainfall-runoff models, Hybrid computers.

The development of mathematical models for runoff forecasting is discussed. The models include rainfall, infiltration, surface retention, evaporation, storage in catchment areas, and routing. Algorithms of the process may be solved on analog, digital, and hybrid computers. (Knapp-USGS)
W69-09277

2B. Precipitation

MANAGING CLIMATIC RESOURCES,
Rand Corp., Santa Monica, Calif.
J. O. Fletcher.

Prepared for publication in Impact, Jour of UNESCO. Rand Corporation, Publ P-4000-1, Mar 1969. 27 p, 3 fig, 18 ref.

Descriptors: *Thermal pollution, *Environmental effects, *Weather modification, *Computer simulation, *Atmospheric physics, Mathematical models, Weather data, Surface-water, Cloud cover, Heat exchange, Ocean circulation, Hydrologic cycle, Albedo, Carbon dioxide.
Identifiers: *Radiation balance, Ice extent, Global climate pattern, Satellite observation.

This report details the present knowledge and technology in observation, prediction and control of a human influence on the global climate by industrial heat discharge. Plans for both regional control of climatic variables and internationally cooperative projects are discussed for the future. Quantification of the global climate pattern involves data of ice extent, radiation variation, and atmospheric circulation. Variations of the patterns must be known (some meteorological history is given) before this data can be successfully used. Although it is concluded that the technological threshold from which progress can be proportional to the investment of effort has been reached, the following considerations are included: Current understanding of atmospheric and oceanic dynamics and heat exchange is too imperfect to predict the outcome of man's efforts to influence thermal forcing in atmospheric circulation. Although it would be theoretically more efficient to act directly on the moving atmosphere, engineering techniques for doing so are not presently available. The diversity of thermal processes that can be influenced in the atmosphere, and between the atmosphere and ocean, offers promise that, if global climate is adequately understood, it can be influenced for the purpose of either maximizing climatic resources or avoiding unwanted changes. (Sherman-Vanderbilt)
W69-09033

DISTRIBUTION OF HEAVY RAINFALL FREQUENCY AND ITS SEASONAL TRANSITION IN TOHOKU DISTRICT,
Tohoku Univ., Sendai (Japan). Faculty of Science.
Koya Hosokawa.
Sci Rep of Tohoku Univ, 7th Ser (Geogr), Vol 18, No 2, p 203-212, Mar 1969. 10 p, 4 fig, 6 ref.

Descriptors: *Rainfall intensity, *Frequency analysis, *Seasonal, Precipitation (Atmospheric), Water shortage, Flooding, Statistical methods, Typhoons, Topography, Summer, Winter, Spring, Climatology, Dynamics.
Identifiers: *Japan, Rainfall frequency.

Heavy rainfall frequency in the Tohoku district of Japan was investigated on the basis of field hydrologic mapping conducted by the author, and by earlier publications. The distribution of frequency varies with the season and can be subdivided into 4 distribution patterns, (February-June, July-August, September-November, and December-January). Seasonal transitions in the Tohoku district and Western Japan are a single microclimatic phenomenon. High frequency areas do not always coincide with the rainy areas, and in February the frequency of heavy snowfalls is high in the Pacific Ocean coastal area usually characterized by small snowfall. (Gabriel-USGS)
W69-09149

HYDROLOGIC CYCLE OF NORTH AMERICA FORMULATED BY THE ANALYSIS OF WATER VAPOR TRANSPORT DATA,
Connecticut Univ., Storrs.
For primary bibliographic entry see Field 02A.
W69-09154

NORMAL ANNUAL PRECIPITATION IN THE WESTERN SIBERIAN PLAIN AND NORTHERN KAZAKHSTAN (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
G. A. Plitkin.
Trudy Gos Gidrol Inst, Issue No 163, p 91-103, 1968. 13 p, 1 fig, 2 tab, 26 ref.

Descriptors: *Precipitation (Atmospheric), *Water balance, Hydrologic data, Meteorological data, Mapping, Rain gages, Evaporation, Gaging stations, Mathematical studies, Statistical methods, Rivers, Watersheds (Basins), Heat balance, Winds.
Identifiers: *USSR, *Siberia (Western), Northern Kazakhstan.

This article describes briefly the earlier publications devoted to the distribution of annual precipitations in the western Siberian plain and northern Kazakhstan, and discusses the reliability of methods used for the evaluation of this distribution. After computing the corrected annual precipitation records in western Siberia and Karakhstan and comparing the water balance and heat balance techniques, the author draws the following conclusions: (1) the normal annual precipitation can be evaluated as the sum of a normal runoff and evaporation in the areas characterized by excessive humidity and paucity of hydrologic and meteorologic observations, with the sum of evaporation and runoff computed after M. I. Budyko's formula; and (2) the normal annual precipitation in the Yamalo-Nenets National district, computed by using the Budyko formula, gave reliable results. (Gabriel-USGS)
W69-09172

THE RAINFALL MEASUREMENT PROBLEM,
Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 07A.
W69-09175

THE HYDROMETEROLOGICAL INTERPRETATION OF THE PRECIPITATION PATTERN,
Meteorologischer Dienst der Deutschen Demokratischen Republic, Berlin. Forschungsinstitut fuer Hydrometeorologie.
H. Schubert.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 232-236, 1968. 5 p, 2 fig, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Rainfall disposition, Networks, Rain gages, Distribution patterns, Isohyets, Hydrologic data, Water yield.
Identifiers: IHD, Rainfall microstructure.

The presentation of the precipitation pattern by meteorological criteria does not truly correspond to the hydrographic structure, this being the primary reason for the differences between the water budget developed from meteorological data and from balancing the water yield. Hence, a method was developed which restricts any subjective judgment of the data required for the preparation of the respective precipitation maps and permits a cartographic presentation of the optimum approximation of the precipitation pattern. A microstructure of the average precipitation pattern may be calculated from isohyetal maps, which is in reasonable agreement with the development of the hydrological network as well as with hydrological estimates by yield balance. (Knapp-USGS)
W69-09176

SYNTHESIS OF SEQUENCES OF SUMMER THUNDERSTORMS VOLUMES FOR THE ATTERBURY WATERSHED IN THE TUCSON AREA,
Arizona Univ., Tucson. Office of Hydrology and Water Resources.
A. Sariahmed, and C. C. Kisiel.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 439-447, 1968. 9 p, 2 fig, 5 tab, 12 ref. OWRR Proj A-010-ARIZ.

Descriptors: *Weather forecasting, *Thunderstorms, *Arizona, *Mathematical models, *Computer models, Digital computers, Simulation analysis, Weather data, Flood forecasting, Rainfall-runoff relationships, Operations research, Systems analysis, Synthetic hydrology, Depth-area-duration analysis.
Identifiers: Tucson (Ariz).

An attempt is made to represent summer thunderstorm occurrences in the Tucson area using some simple probabilistic principles and a digital computer. The purpose of the model is to forecast many of the characteristics of the summer thunderstorms (storm duration, time between storms, storm depth, daily totals, etc). Such a simulation model is intended as an input to a watershed model for flood forecasting. Development of the model is part of an operations research study of the hydrology and water resources of the Tucson basin. The synthetic data exhibits many of the characteristics of the historical sequences. However, the correlation between storm depth and storm duration is weaker for the synthetic data than for its historical counterpart. The model conserves the mean rainfall (seasonal, monthly, daily totals). (Knapp-USGS)
W69-09190

APPRAISAL OF RESEARCH ON WEATHER AND CLIMATE OF DESERT ENVIRONMENTS,
Arizona Univ., Tucson; and Army Natick Labs., Mass.
Clayton H. Reitan, and Christine R. Green.
IN W. G. McGinnies, B. J. Goldman, and Patricia Paylore, eds., Deserts of the World, an Appraisal of Research into their Physical and Biological Environments, p 19-92, University of Arizona Press, Tucson, 1968. 74 p, 3 tab, 482 ref.

Descriptors: *Deserts, *Arid climates, *Synoptic analysis, Arid lands, Semi-arid climates, Air circulation, Climatic data, Microclimatology, Evapotranspiration, Evaporation, Weather modification, Dust storms, Cloud bursts, Dew, Fog, Precipitation (Atmospheric), Thunderstorms, Weather patterns, Cloud cover, Weather data, Bibliographies, Winds, Irrigation effects, Shelterbelts, Solar radiation, Climatic zones.
Identifiers: Australian Deserts, Monte-Patagonian Desert, Atacama-Peruvian Desert, Kalahari-Namib Desert, Sahara Desert, Somali-Chalb Desert, Arabian Desert, Iranian Desert, Thar Desert, Turkestan Desert, Takla-Makan Desert, Gobi Desert, North American Deserts.

This paper is a survey of what is known about the weather and climate of the deserts of the world and an evaluation of research needs. Climatic briefs are presented for the major world deserts. These include major references for climatic data and for synoptic climatology. Desert storms and upper-air circulations are each discussed. The concept of aridity is considered in relation to theoretical and empirical measurements of water use, oasis effect, potential evapotranspiration, classification of climate, indexes or aridity, and climatic analogs. Other topics treated are weather modification, microclimate, radiation, bibliographies and depositories. The lack of a satisfactory system for determining water need and water use, and for expressing aridity in those terms is emphasized. The empirical equations of Penman and Budyko are suggested to be the most practical methods of estimating water need. If aridity and quantitative estimates of water need are to be defined and determined in terms of these equations, ordinarily unavailable climatological data such as radiation measurements, cloud cover and vapor pressure will be required. More field studies are needed to determine the variations of climate that occur on the mirco- and meso-scale of distance. The level of current research and the authorities are discussed for each desert region of the world. (See W69-09206). (Sherbrooke-Ariz)
W69-09207

METEOROLOGICAL EXPERIMENTS FOR AUTOMATED SATELLITES,
National Aernautics and Space Administration, Washington, D.C. Dept. of Meteorology and Soundings.
For primary bibliographic entry see Field 07B.
W69-09242

RUNS OF PRECIPITATION SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Mathematics and Statistics.
For primary bibliographic entry see Field 07B.
W69-09250

2C. Snow, Ice, and Frost

SOIL WATER MOVEMENT AS AFFECTED BY DEEP FREEZING,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02G.
W69-09139

SATELLITE APPLICATIONS TO SNOW HYDROLOGY, 1968,
Environmental Science Services Administration, Rockville, Md.
For primary bibliographic entry see Field 07B.
W69-09178

2D. Evaporation and Transpiration

HYDROLOGIC CYCLE OF NORTH AMERICA FORMULATED BY THE ANALYSIS OF WATER VAPOR TRANSPORT DATA,
Connecticut Univ., Storrs.
For primary bibliographic entry see Field 02A.
W69-09154

COMPUTER SIMULATION OF REMOTE SENSING BY MICROWAVE RADIOMETERS,
Ryan Aeronautical Co., San Diego, Calif.
For primary bibliographic entry see Field 07C.
W69-09194

ALTERING THE WATER BALANCE OF THE CASPIAN SEA BY REDUCING THE EVAPORATION AREA,
Astrakhan Hydrometeorological Observatory (USSR).
Ye. M. Kopaygorodskiy.
Oceanology, Vol 7, No 1, p 91-93, 1967. 3 p, 2 fig. Trans by Amer Geophysical Union from Okeanologiya, Akad Nauk, SSSR, Vol 7, No 1.

Descriptors: *Water balance, *Sea level, Evaporation, Surface runoff, Precipitation (Atmospheric), Groundwater movement, Dam construction, Surface water, Groundwater.
Identifiers: USSR, *Caspian Sea, *Sea level stabilization.

The maintaining of a constant level of the Caspian Sea is important for the national economy of the Soviet Union. It was calculated that a 2-m fall in the sea level produced a 29,000 sq km reduction of the North Caspian Sea. The water balance of the sea was used for calculation of the sea level stabilization. The water balance requires the knowldege of the following factors: surface runoff, groundwater flow, amount of precipitation on the sea, evaporation from the sea surface, discharge into the Kara Bogaz Gol, the fall in the sea level. The water balance equation was solved and it showed an annual deficit of 682 mm. Therefore, the Caspian Sea should receive this amount annually in order to maintain a constant level. The dam construction and other engineering structures were proposed to change the hydrologic regime of the sea. (Carstea-USGS)
W69-09202

CO sub 2 - GAS EXCHANGE AND WATER RELATIONS OF PLANTS IN THE NEGEV DESERT AT THE END OF THE DRY PERIOD,
Hebres Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 02I.
W69-09204

THE EFFECT OF THE ADDITION OF HEAT FROM A POWERPLANT ON THE THERMAL STRUCTURE AND EVAPORATION OF LAKE COLORADO CITY, TEXAS, (STUDIES OF EVAPORATION),
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05C.
W69-09320

2E. Streamflow and Runoff

THE FLORENCE FLOODS,
Vermont Univ., Burlington. Dept. of Botany.
Richard M. Klein.
Natur Hist, Vol 78, No 7, p 46-54, Aug-Sept 1969. 1 fig, 4 photo.

Descriptors: *Floods, *Rainfall-runoff relationships, Streamflow, Discharge (Water), Disasters, Watershed management, Flood control, Flood protection, River training, Politcal aspects, Economics.
Identifiers: *Florence (Italy), Arno River.

The recent floods in Florence, Italy are not unique. The city has a long history of flood disasters caused by improper agricultural development of the Arno watershed in Tuscany, together with total law of flood control of the river. Of the 25-40 inches of rain every year in Tuscany, over 80% falls between October and January. The Tuscan hills have almost no vegetation except olives and grapes, no ground cover to retard runoff, and a nearly impervious soil surface. Since 1333 there has been a moderate flood every 24 years, a major flood every 26 years, and a disastrous flood every 100 years. The city's plan is ideal for intensifying flood damage, with its squares which fill rapidly and empty slowly, and a general layout that impedes runoff. No flood control, flood protection, or river training has ever been attempted. (Knapp-USGS)
W69-09132

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
California State Dept. of Water Resources, Los Angeles.
For primary bibliographic entry see Field 04B.
W69-09136

FLOODS ON LICKING RIVER IN VICINITY OF SALYERSVILLE, KENTUCKY,
Geological Survey, Washington, D.C.
Curtis H. Hannum.
Geol Surv Hydrol Invest Atlas HA-329, 1 sheet, 1969. Text, 6 fig, 1 map, 2 photo, 1 tab, 2 ref.

Descriptors: *Floods, *Kentucky, *Stage-discharge relations, Discharge (Water), Streamflow, Surface waters, Hydrologic data, Flood control, Non-structural alternatives.
Identifiers: *Salyersville (Ky), Licking River.

A 1-sheet hydrologic atlas presents data that can be used to evaluate the extent, depth, and frequency of floods that affect the economic development of flood plains of the Licking River near Salyersville, Kentucky. The data provide a basis for solving existing flood plain problems and formulating regulations for land use and development that will reduce future flood damage. The report will be useful for preparing building and zoning regulations, locating waste disposal and water treatment facilities, and developing recreational areas. The flooded areas of 5, 25, and 50 year floods are shown on a 1:12,000 topographic map. Photographs, cross sections, profiles, text, and recurrence charts describe the flooding. (Knapp-USGS)
W69-09153

PEBBLE ORIENTATION IN A RECENT GRAVEL CHANNEL,
Akademiya Nauk SSSR. Sibirskoe Otdelenie. Institut Geologii i Geofiziki.
For primary bibliographic entry see Field 02J.
W69-09163

PROPAGATION OF THE FLOWS DISCHARGED BY THE 'GHEORGHE GHEORGHIU-DEJ' HYDROELECTRIC PLANT IN THE ARGES RIVER BED (ROMANIAN),
Institute of Hydrotechnical Research, Bucharest (Rumania).
For primary bibliographic entry see Field 04A.
W69-09166

EFFECT OF KARST ON THE MINIMAL RUNOFF OF THE PLAINS RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
O. L. Markova.
Trudy Gos Gidrol Inst, Issue No 163, p 30-40, 1968. 11 p, 5 fig, 3 tab, 18 ref.

Descriptors: *Runoff, *Rivers, *Karst, River basins, Low water mark, Water circulation, Streamflow, Water control, Watersheds (Basins), Hydrologic data, Hydrogeology, Groundwater movement, Seasonal, Limestones, Dolomite, Geologic mapping, Structural geology.
Identifiers: *USSR, River runoff.

Minimal runoffs of rivers in karstic areas were analyzed on the basis of hydrogeological and meteorological data recorded in the Onega-Severnaya Dvina, Silurian plateau, Northern Volga, and Cisuralian regions. The karstic areas are important factors affecting the minimal runoffs; the effects of karstic areas are determined by a degree of their karstification and hydrogeologic characteristics. The effect of karst is manifested by a decrease in small stream runoffs and by an increase in groundwater runoff. Mean minimal 30-day drainage of karstic rivers draining groundwaters is considerably higher, 2 to 4 times, than that shown by zonal values. Karstic rivers draining groundwater reservoirs are characterized by consistency in maintaining their minimal runoffs. The evaluation of minimal runoff in karstic areas is difficult because the runoff is affected by several conditions which are difficult to evaluate. (Gabriel-USGS)
W69-09168

MINIMAL RUNOFFS OF TRANSBAIKALIAN RIVERS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
Z. I. Peterson.
Trudy Gos Gidrol Inst, Issue No 163, p 41-54, 1968. 14 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Runoff, *Rivers, *Discharge (Water), Mining, Water utilization, Gaging stations, Hydrogeology, Geologic mapping, Winter, Summer, Watersheds (Basins), Aquifers, Floods, High water mark, Water sources, Hydrographs, Precipitation (Atmospheric), Fissures (Geology), Winds.
Identifiers: *USSR, Amur River, Lena River, Yenisey River.

Minimal runoffs in the upper reaches of the Yenisey, Lena, and Amur River basins were analyzed on the basis of hydrogeological and meteorological data recorded during the 1959-1965 period. Using maps of distribution of minimal 30-day and annual water discharges and the tables of basic parameters of minimal runoffs, the Transbaikal region can be subdivided into 6 districts characterized by their distributions of annual precipitation and river discharges. (Gabriel-USGS)
W69-09169

ELECTRONIC MODELING METHOD OF CALCULATING STORMFLOW IN STEPPE AND FOREST-STEPPE AREAS OF EUROPEAN USSR (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.

W69-09170

MEAN LONG-TERM WATER BALANCE OF MOUNTAIN WATERSHEDS BASED ON THE DATA OF TRANSCARPATHIAN GAGING STATIONS (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
M. I. Kirilyuk.
Trudy Gos Gidrol Inst, Issue No 163, p 55-90, 1968. 36 p, 3 fig, 12 tab, 25 ref.

Descriptors: *Water balance, *Watersheds (Basins), *Discharge (Water), *Gaging stations, Agricultural watersheds, Streamflow, Geologic control, Soils, Forests, Precipitation (Atmospheric), Climates, Evaporation, Mathematical studies, Aquifers, Snow.
Identifiers: *USSR, Transcarpathian river basins.

An analysis is made of the effect of various basic parameters on the long-term water balance of the Rika River basin of Transcarpathia. Data recorded at 441 to 1431 m altitudes in 1947 to 1966 show that the monthly and annual precipitations are a function of altitude of the watersheds. The evaporation values for the basin were evaluated by using an equation of heat balance based on the actinometric observations recorded at the Mezhgor'ye gaging station. Changes in the supply of moisture in the snow cover, soils, and groundwater reservoirs were analyzed by using the corresponding data. Precipitation and runoff increase and the evaporation does not change with the watershed altitude. (Gabriel-USGS)
W69-09171

INVESTIGATIONS OF UNSTEADY WATER FLOW AND RIDGE-LIKE SEDIMENT DISPLACEMENT (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
M. S. Grushevskiy, A. A. Ivanova, V. A. Erikson, L. I. Rozenberg, and M. I. Rusinov.
Trudy Gos Gidrol Inst, Issue No 161, 1968. 128 p, 33 fig, 13 tab, 144 ref.

Descriptors: *Unsteady flow, *Streamflow, *Sediment transport, Hydrologic data, Analysis, Discharge (Water), Runoff, Waves (Water), Backwater, River beds, Tsunamis, Water transfer, Hydroelectric.
Identifiers: *USSR, Stream sediment transfer.

This monograph of 128 pages represents 8 investigations on unsteady water flow and sediment transport based on the analytical and experimental studies of data recorded in the USSR. The collection consists of the following articles: (1) Complex investigations of the unsteady flow in revers, as conducted by the State Geological Institute; (2) Analysis of natural data pertaining to the measurements of water discharges and hydraulic resistance under conditions of unsteady flow; (3) Investigation of water waves in the lower reaches of the Ivan'kovsk hydroelectric station; (4) Some peculiarities in computing unstable water flows under the conditions of backwash; (5) Approximate dependence of the velocity of propagation in a prismatic river channel with a flood plain (6) One-dimensional model for the calculation of unsteady water flows in rivers characterized by complex flood plains; (7) Study of the transformation of the Tsunamis long waves, using the Kamchatka Bay space model; and (8) Study of ridgelike displacement of the river Polometi sediments. (Gabriel-USGS)
W69-09173.

REGIME, THEORY, AND CALCULATION AND MEASUREMENT METHODS OF SEDIMENTATION AND WATER RUNOFF (RUSSIAN),
V. M. Makkaveyev, K. V. Razumikhina, I. V. Bogolubova, V. V. Romanovskiy, and N. M. Kapitonov.
Trudy Gos Gidrol Inst, Issue No 156, 1968. 178 p, 33 fig, 45 tab, 133 ref.

Descriptors: *Sediments, *Runoff, *Mathematical studies, *Methodology, Streamflow, Turbulent flow, Rivers, Kinetics, Suspended load, Photography, Physical properties, Geographical regions, River basins, Irrigated land, Waves (Water), Wind velocity.
Identifiers: *USSR, Regime theory, Sedimentation theory and measurement, Water runoff theory and measurement.

This book is a collection of 12 investigations on the regime, theory, and calculation and measurement of sediments and water runoff based on analytical and experimental studies using the data recorded in the USSR. The following articles describe the studies: (1) Kinetics of turbulent river flow and the effect of sediments; (2) Some experience in the theoretical study of suspended load discharge of flat area rivers; (3) Results of field investigations and the calculation of runoff-entailed sediments of the Mzymty River; (4) Photographic method of granulometric analysis of course sediments; (5) Determination of the mean long-term annual discharge of sediments by taking physico-geographical conditions into consideration; (6) Study of discharge sediments of the Polomet River basin; (7) Sediment discharges of the rivers of the maritime province; (8) Determination of the norms and cyclic oscillations of the discharge of suspended load; (9) Field investigations of the sediments of irrigated lands; (10) The basis of turbidity formulas in evaluating wave spectra; (11) Principles of wind current modeling and the formation of pollution in water reservoirs; and (12) Natural study of dilution of river runoff and verification of calculating methods. (Gabriel-USGS)
W69-09174

DETERMINATION OF MIXING LENGTHS IN DILUTION GAUGING,
Water Research Association, Medmenham (England).
A. Barsby.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 395-407, 1968. 13 p, 6 fig, 8 ref.

Descriptors: *Tracers, *Tracking techniques, *Discharge measurement, *Mixing, Diffusion, Dispersion, Dye releases, Discharge (Water), Streamflow, Stream gages, Streamflow forecasting.
Identifiers: Dilution gaging (Streamflow), England.

Dilution gaging of river discharge depends on the injected tracer becoming adequately mixed with the flow before sampling. However, as dispersion along a needlessly great mixing length is wasteful of time and tracer, it is important to determine the minimum length of mixing, by calculation from channel and flow parameters or observation of the dispersion of a preliminary injection. Constant rate injections were used in a series of 9 tests of discharges ranging from 0.05 to 5 cu m/sec. At several stations along each stream, mixing was observed by measuring the variation in concentration from bank to bank. By using logarithmic interpolation of observed mixing at each station, deduced lengths for 99% mixing were compared with results given by empirical formulae. The most satisfactory of these was Rimmar's, and a modification of his formula is suggested, permitting evaluation of mixing lengths from easily measured parameters. Sayre's equation for lateral dispersion in a finite channel was developed to provide a simple technique of extrapolating from a partial mixing length to the 99% mixing length. Accordingly, preliminary injection experiments can be conducted over a small fraction of the eventual mixing length. Generally, calculations from channel parameters seems preferable in small turbulent streams, where a conservative estimate would be tolerable; the preliminary injection method is recommended for larger rivers where accuracy of prediction justifies the additional work involved. (Knapp-USGS)
W69-09177

THE USE OF STATISTICAL METHODS FOR SHORT-RANGE FORECASTS,
Hydrometeorological Service of the USSR (Moscow).
N. S. Nechaeva, and V. M. Mukhin.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 405-416, 1968. 12 p, 3 fig, 2 tab, 6 ref.

Descriptors: *Statistical models, *Runoff forecasting, *Streamflow forecasting, Regression analysis, Digital computers, Computer programs, Gages.
Identifiers: *USSR, Short-range streamflow forecasts, Principal component analysis.

The forecasting of river stages and discharges by statistical methods in the USSR is discussed. Because several requirements for direct regression are often not met by collected data, careful selection of gages is necessary. The method of principal components has the advantages of good simulation of events and the stability of coefficients of linear equations. The use of matrices greatly simplifies computation by computers of by manual methods. (Knapp-USGS)
W69-09187

PROBLEMS IN SIMULATING AND EVALUATING VARIOUS METHODS OF LINEAR FLOOD ROUTING USING A SMALL DIGITAL COMPUTER,
University Coll., Cork (Ireland).
For primary bibliographic entry see Field 07C.
W69-09188

MAKING ANALYTICAL TOOLS IN WATER RESOURCES MANAGEMENT USABLE,
TRW Systems Group, Redondo Beach, Calif.; and San Bernardino Valley Municipal Water District, Calif.
For primary bibliographic entry see Field 06A.
W69-09189

STUDY OF THE NUMERIC CALCULATIONS OF THE PROPAGATION OF FLOODS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
M. A. Daubert.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 456-472, 1968. 17 p, 10 fig, 1 tab.

Descriptors: *Flood forecasting, *Mathematical models, *Digital computers, Model studies, Rainfall-runoff relationships, Runoff forecasting, Routing, Water management (Applied), Hydrographs, Stage-discharge relations, Flood routing.
Identifiers: *France, Rhone River, Rhine River, Explicit methods, Implicit methods.

Mathematical models are coming into increasing use as a means of investigating unsteady river and channel flow. Their potential scope is briefly described. The Saint-Venant equations for gradually varying unsteady flow constitute a hyperbolic quasilinear system. The can be integrated by 2 basic numerical methods: explicit methods and implicit methods. Each problem is represented by a hydraulic scheme allowing for the various ramifications and featuring all the weirs, flow inputs, cross-sectional changes, diversions and other special points in the system. One or 2 conditions (hydrograph or level chart) will be given upstream from each branch, and a stage-discharge relationship or a level record downstream from the model, also an operating relationship for each singular point. The initial conditions also require defining. They can be calculated for steady flow, but if the phenomenon is already developing at the point at which the calculation starts, they have to be assumed; they are usually of little importance, however, as their effects are no longer felt after a certain time. Examples of flood-routing studies mentioned are a study of the Rhine at Karlsruhe and of the Rhone above

Lyons. The Rhine's hydraulic scheme features a number of hydro-power plants and that of the Rhone several weirs. (Knapp-USGS)
W69-09192

USE OF DIGITAL COMPUTERS IN INTERNATIONAL WATER RESOURCES INVESTIGATIONS,
Food and Agriculture Organization of the United Nations, Rome (Italy).
For primary bibliographic entry see Field 07C.
W69-09195

GROUNDWATER-STREAMFLOW SYSTEMS IN WILSON CREEK EXPERIMENTAL WATERSHED, MANITOBA,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering; and Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
For primary bibliographic entry see Field 02A.
W69-09237

SOME GUIDELINES FOR REMOTE SENSING IN HYDROLOGY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W69-09241

METEOROLOGICAL EXPERIMENTS FOR AUTOMATED SATELLITES,
National Aernautics and Space Administration, Washington, D.C. Dept. of Meteorology and Soundings.
For primary bibliographic entry see Field 07B.
W69-09242

FLOOD-FORECAST SYSTEM IN THE MEKONG DELTA, CAMBODIA,
Compagnie Nationale du Rhone, Lyon (France).
Yves Menard.
Nature and Resources, Vol 5, No 2, p 2-4, June 1969. 3 p.

Descriptors: *Flood forecasting, *Mathematical models, *Deltas, *Routing, Water levels, Streamflow, Rainfall-runoff relationships, Rainfall disposition, Runoff forecasting, Floods.
Identifiers: *Cambodia, *Mekong Delta.

Floods of the Mekong Delta, Cambodia are forecasted by use of a mathematical model built to fit delta geography and hydrology. The model is also used to study the feasibility of flood control by building a gate dam on the Tonle Sap to control water flow between the Mekong and the Great Lake. With proper calibration the model determines water levels throughout the Delta, and routing equations describe flood wave propagation for the entire area when rainfall distribution and water levels are known. (Knapp-USGS)
W69-09245

SPECIAL FLOOD HAZARD INFORMATION, SHOAL CREEK, JOPLIN, MISSOURI.
Corps of Engineers, Tulsa, Okla.
For primary bibliographic entry see Field 06F.
W69-09259

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN FLORIDA.
Corps of Engineers, Atlanta, Ga. South Atlantic Div.
For primary bibliographic entry see Field 04A.
W69-09262

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY OF ENGINEERS IN MINNESOTA.
Corps of Engineers, Chicago, Ill. North Central Div.
For primary bibliographic entry see Field 04A.
W69-09263

GENERATION OF FITTING PROBABILITY DISTRIBUTION FUNCTIONS OF DISCHARGES BY ELECTRONIC COMPUTER,
Research Inst. for Water Resources Development, Budapest (Hungary); and Eotvos Lorand Univ., Budapest (Hungary). Dept. of Theory of Probability.
For primary bibliographic entry see Field 07C.
W69-09268

ON A PROBLEM OF FIXATION OF RESERVOIR CAPACITY SOLVED WITH THE HELP OF ELECTRONIC COMPUTER,
Central Water and Power Commission, New Delhi (India).
For primary bibliographic entry see Field 07C.
W69-09269

A DIMENSIONLESS REPRESENTATION OF FLOOD WAVE SUBSIDENCE BY MEANS OF A SUBSIDENCE FUNCTION,
Netherlands, Rijkswaterstaat.
J. W. Van der Made.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 569-583, 1968. 15 p, 11 fig, 1 tab, 2 ref.

Descriptors: *Floods, *Recession curves, *Computer programs, Flood plains, Flood forecasting, Streamflow forecasting, Stage-discharge relations, Routing, Hydrographs, Hydrograph analysis.
Identifiers: Forchheimers formula, Flood waves.

By applying Forchheimer's formula for flood wave crest subsidence in a discharge profile with partly or entirely inundated flood plains, a relation was developed between the subsidence of a unit runoff in a unit profile and the subsidence of a variable runoff in the profile considered. Numerical values of a 'subsidence function' were derived from a computer calculation. Observations of an actual situation fit reasonably the theoretical scheme. (Knapp-USGS)
W69-09272

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 07C.
W69-09273

SELF-SIMILAR SYNTHETIC HYDROLOGY,
IBM Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 07C.
W69-09280

FLOOD PLAIN INFORMATION, SOUTH FORK ZUMBRO RIVER AND TRIBUTARIES, ROCHESTER, MINNESOTA.
Corps of Engineers, St. Paul, Minn.
For primary bibliographic entry see Field 04A.
W69-09286

2F. Groundwater

APPLICATION OF DEEP ELECTRICAL SOUNDINGS FOR GROUNDWATER EXPLORATION IN HAWAII,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W69-09133

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
California State Dept. of Water Resources, Los Angeles.
For primary bibliographic entry see Field 04B.
W69-09136

SIMULTANEOUS FLUXES OF LIQUID AND CHARGE IN SATURATED KAOLINITE,
Geological Survey, Menlo Park, Calif.
Harold W. Olsen.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 338-344, May-June 1969. 7 p, 9 fig, 2 tab, 8 ref.

Descriptors: *Saturated flow, *Clays, *Ion transport, *Electrolytes, *Thermodynamics, Kaolinite, Mass transfer, Darcy's law, Heat transfer, Diffusion.
Identifiers: *Irreversible thermodynamics.

Experimental data obtained on a liquid saturated sample of sodium kaolinite consolidated under 408 kg/sq cm, show that the simultaneous fluxes of liquid and charge under hydraulic, electrical, and electrolyte concentration gradients obey the macroscopic rate laws derived from the irreversible thermodynamics of discontinuous systems, except that the experimental flux versus driving force relations possess hydraulic and electrical potential intercepts. It is proposed that the intercepts arise from electrolyte concentration gradients within the sample, generated by differential salt filtering at the sample surfaces during consolidation increments. This mechanism is suggested by nonsymmetrical details in the mechanical system used to consolidate the sample, and it provides an explanation for the intercepts which is not inconsistent with the fundamental postulates of irreversible thermodynamics. (Knapp-USGS)
W69-09140

GROUND-WATER RESOURCES OF JOHNSON COUNTY, TEXAS,
Geological Survey, Austin, Tex.
Gerald L. Thompson.
Tex Water Develop Board Rep No 94, Apr 1969. 84 p, 17 fig, 8 tab, 38 ref.

Descriptors: *Water resources, *Groundwater, *Texas, Water wells, Water yield, Water quality, Aquifers, Water utilization, Hydrologic data, Data collections, Water levels, Water-level fluctuations.
Identifiers: *Johnson County (Tex).

About 3.2 mgd or 3,600 acre-ft annually, of groundwater was used in Johnson County Texas in 1966 for public supply (1.2 mgd), rural domestic (0.98 mgd), livestock (0.89 mgd), and industrial (0.17 mgd) needs. Part of the water for public supply and industrial uses in the central part of the county is surface water obtained from recently constructed reservoirs. The principal water-bearing formations in the county and the approximate quantity of water supplied in 1966 are, as follows: Hosston Formation, 580 acre-ft; Travis Peak Formation, 360 acre-ft; Paluxy Sand, 2,000 acre-ft; Woodbine Formation, 680 acre-ft; and a small quantity from the Quaternary alluvial deposits. About half of the water now being withdrawn from the Paluxy comes from storage; the Paluxy transmits about 1,000 acre-ft per yr (about 1 mgd) less than the quantity currently being pumped in the county. In 1966, pumpage from the Woodbine was less than half of the amount transmitted. Also, there is available from storage in the Woodbine in the eastern part of the county, about 2,100,000 acre-ft of water. (Knapp-USGS)
W69-09148

A POSSIBLE THERMAL SPRING DEPOSIT IN THE 'ARAD AREA, ISRAEL,
Geological Survey of Israel, Jerusalem.
For primary bibliographic entry see Field 02K.
W69-09158

A NOTE ON THE POSSIBLE ORIGIN OF THE SO-CALLED KARSTIC CAVES AT MA'ALE HAMESHAR IN THE CENTRAL NEGEV,
A. Issar, and Shulamit Gross.
Israel J Earth-Sci, Vol 18, No 1, p 29-32, 1969. 4 p, 5 fig, 9 ref.

Descriptors: *Karst, *Thermal water, Mineralogy, Groundwater movement, Solutes, Aqueous solution, Solubility, Thermal springs, Carbonate rocks, Water chemistry, Manganese.
Identifiers: *Israel, Negev.

Caves formed by solution processes are reported from the central Negev. The caves were assumed to have formed by karst-forming processes involving dissolution of rocks by meteoric water circulation. Further studies of this phenomenon revealed mineralization phenomena which make it difficult to attribute to the caves a normal karstic genesis and which indicate a process involving ascending mineralized water. (Knapp-USGS)
W69-09159

GROUND-WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
Idaho Bureau of Mines and Geology, Moscow.
Roy E. Williams.
Idaho Bur Mines and Geol Pam No 141, Aug 1968. 15 p, 3 fig, 39 ref.

Descriptors: *Water chemistry, *Groundwater, *Saline water systems, Aqueous solutions, Groundwater movement, Porosity, Permeability, Solubility, Leaching, Solutes.
Identifiers: *Evaporites.

Study of the literature on evaporite mineral deposits suggests a functional relationship between the origin of these deposits and ground water flow systems. The theory on which the analysis of groundwater flow systems is based is reviewed in order to establish flow systems as a mechanism by which dissolved solids can be transported to sites of evaporite mineral accumulation. Comparison of observed spatial variations of groundwater quality with pertinent solutions to flow equations under specified boundary conditions reveals that quality of groundwater is a function of flow path length, flow path route and flow velocity. Selected references provide evidence that sites of accumulation of non-marine evaporite minerals are discharge zones for poor quality water from regional groundwater flow systems. A study of isotope rations in oil field brines and standard mean ocean water indicates that water in some deep brines is of local meteoric origin; therefore, the brines are part of a groundwater flow system. Observed distribution of fluid potential in the saline portion of some groundwater flow systems on the Atlantic Coast of the United States reveals that saline groundwater discharges toward the ocean floor. Therefore, groundwater may also act as a transport medium for dissolved solids which are precipitated, under appropriate conditions, as marine evaporite deposits. (Knapp-USGS)
W69-09160

EXPERIENCES GAINED WITH DIGITAL COMPUTERS IN ANALYZING THE DISCHARGE AND THE RADIUS OF INFLUENCE OF WELLS IN POROUS AQUIFERS,
Design Bureau for Hydraulic Planning, Budapest (Hungary).
S. Leczfalvy.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol Publ No 81, p 368-377, 1968. 10 p, 7 fig, 2 tab.

Descriptors: *Mathematical models, *Groundwater movement, *Digital computers, Steady flow, Unsteady flow, Water table, Discharge (Water), Aquifers, Drawdown, Drainage systems, Recharge, Infiltration, Seepage.
Identifiers: Hungary.

The relations of discharge and radius of influence to infiltration rates, hydraulic gradient, and regional water table in constant-drawdown wells and mine drains are studied. The derivation of descriptive formulae was aided by computers. Analysis of data showed that the radius of influence was greatly diminished with higher infiltration rates without increase of discharge. The greatest influence on discharge is exerted by permeability. Solutions of seepage and groundwater movement problems are presented for horizontal and tilted water tables replenished by precipitation, with both steady and non-steady flow. (Knapp-USGS)
W69-09184

SIMULATION OF THE HYDROLOGIC-ECONOMIC FLOW SYSTEM,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W69-09185

ANALYTIC TECHNIQUES FOR DETERMINING GROUND WATER FLOW FIELDS,
California Univ., Berkeley. Hydraulic Engineering Lab.
Mohsen Shahbazi, and David K. Todd.
Calif Univ Water Resources Center Contrib No 117, Aug 1967. 139 p, 26 fig, 36 ref, 4 append.

Descriptors: *Groundwater movement, *Steady flow, *Model studies, *Groundwater basins, Infiltration, Discharge (Water), Recharge, Mathematical models, Hydraulic models, Flow nets, Synthetic hydrology, Water levels, Saturated flow.
Identifiers: *Hele-Shaw models.

Analytic techniques were developed and applied to the study of the flow pattern in a two-dimensional steady state, homogeneous isotropic groundwater basin. The geometry of the zones of recharge and discharge is a function of ground-surface profile, variation in rate of recharge, hydraulic conductivity of porous media, and the geometry of the flow domain. Two independent methods of solution, using least square and Fourier expansion, were developed to solve the Laplace equation for single-layered and multi-layered systems; the results were checked with laboratory experiments using the Hele-Shaw model. A mathematic model was formulated to accurately describe the flow pattern in a two-dimensional steady state groundwater basin. (Knapp-USGS)
W69-09196

METHODS AND TECHNIQUES OF GROUNDWATER INVESTIGATION AND DEVELOPMENT,
United Nations Educational, Scientific and Cultural Organization, New York; and Economic Committee for Asia and Far East.

United Nations Publication, Water Resources Ser No 33, 1967. 206 p, 79 fig, 25 tab.

Descriptors: *Groundwater, *Water resources development, *Water management (Applied), Surveys, Tracers, Hydrogeology, Model studies, Water storage, Systems analysis, Optimization, Economics.
Identifiers: ECAFE, Far Eastern Nations.

The proceedings of the 2nd seminar on methods and techniques of Groundwater Investigations consist of seminar discussions, lectures by consultants, and a collection of hydrological papers by conference participants. The topics presented in detail include field procedures, water resources evaluations, water storage, analog models, mathematical models, water resources management, hydrogeology, isotope investigations, and groundwater studies in the nations of the ECAFE Region. (Knapp-USGS)
W69-09197

THEORETICAL ANALYSIS OF GROUNDWATER BASIN OPERATIONS,
California Univ., Berkeley. Hydraulic Engineering Lab.
William D. McMillan.
Calif Univ Water Resources Center Contrib No 114, Nov 1966. 167 p, 17 fig, 20 tab, 117 ref, 3 append.

Descriptors: *Groundwater basins, *Model studies, *Statistical models, Mathematical models, Hydraulic conductivity, Computer programs, Synthetic hydrology, Groundwater movement, Permeability.
Identifiers: Richards equation, Basinwide management.

A statistical treatment was utilized to study the relative importance of basin-wide heterogeneity in operational analysis of groundwater basins. Richard's equation was solved for a range of conditions to evaluate the difference in homogeneous and heterogeneous conditions. The variances of assumed randomly distributed conductivity values and the resulting potential field displacements were found to be closely related. Analysis of conductivity data from several sources indicated that conductivity values tended to follow a lognormal distribution. Frequency analyses of available field data indicated that the conductivity logarithms were normally distributed with variance values in the range 0.5 to 0.8. Digital computer programs were developed and utilized to evaluate the relationship between the conductivity deviation and the resulting variation in the potential field for 1, 2, and 3 dimensional flow-fields over a range of values of mean conductivity, mean potential gradient, and basin size and shape. A statistical evaluation of this relationship was obtained by means of repetitive numerical solutions using machine-generated random conductivity samples with selected distribution parameters. (Knapp-USGS)
W69-09198

FRESH-WATER SPRINGS OF HAWAII FROM INFRARED IMAGES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W69-09199

GENERAL REPORT ON THE GROUNDWATER INVESTIGATION OF THE AZRAQ BASIN.
United Nations Development, New York.

United Nations Develop Programme Rep, 1966. 64 p, 15 fig, 5 map, 20 tab, 46 ref, append.

Descriptors: *Water resources, *Groundwater, *Groundwater basins, *Arid lands, United Nations, Surveys, Water wells, Water yield, Water quality, Recharge, Discharge (Water), Hydrologic data, Data collections, Water sources, Aquifers, Springs.
Identifiers: *Jordan, *Azraq Basin.

The Azraq Basin, Jordan, is a desert area of interior drainage. Springs near the center support a small agricultural and salt-producing economy. The geologic formations exposed in the basin range in age from cretaceous to recent, and include sedimentary and volcanic rocks. Both types of rocks yield water to the springs in El-Azraq and to wells at scattered places in the basin. The wells tap both artesian and unconfined groundwater, but specific capacities and permeabilities generally are low. Exploratory drilling and testing in the basin show that aquifers in the deep-lying Kurnub sandstone are at too great a depth to be economically exploited for water, and that the permeability of the formation is low in the Azraq area. The overlying Ajlun Series does not contain groundwater in significant quantities. The lower aquifers in the next overlying Belqa Series of sedimentary rocks probably are at too great a depth to be exploited under present economic conditions. Withdrawal of groundwater from the aquifers at intermediate and shallow depths in the sedimentary and volcanic rocks is feasible, but the perennial supply is limited and withdrawals of any magnitude will reduce the discharge of the springs at El-Azraq. Perennially available water resources of the basin are very limited, and are being used at the optimum rate and that any additional large-scale development would upset the water-resources regimen and economy of the basin. Recharge was estimated to be about 2% of precipitation. Much of the groundwater is of marginal or unsuitable quality for irrigation because it has a high sodium and salinity hazard. (Knapp-USGS)
W69-09200

THE INK POTS-A GROUP OF KARST SPRINGS IN THE ROCKY MOUNTAINS NEAR BANFF, ALBERTA,
Department of Energy, Mines and Resources, Calgary (Alberta). Inland Waters Branch.
R. O. Van Everdingen.
Can J Earth Sci, Vol 6, No 4, Part 1, p 545-554, Aug 1969. 10 p, 8 fig, 2 tab, 5 ref.

Descriptors: *Springs, *Karst, *Carbonate rocks, *Rocky Mountain region, Currents (Water), Discharge (Water), Water quality, Water chemistry, Water circulation, Groundwater movement, Recharge.
Identifiers: *Canada, Alberta, Banff.

The Ink Pots are a group of springs in Banff National Park. The one feature that makes these springs of more than passing interest is the greenish milky appearance of two of the ponds in the group. This difference in appearance of the water cannot be explained by dissolved or suspended chemicals, or by algae growth. It can be explained by differences in flow velocity, which cause differential suspension of fine sand and silt. Temperature and chemical character of spring water from the Ink Pots indicate, respectively, shallow circulation and a relatively short 'contact' time. (Knapp-USGS)
W69-09236

GROUNDWATER-STREAMFLOW SYSTEMS IN WILSON CREEK EXPERIMENTAL WATERSHED, MANITOBA,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering; and Manitoba Univ., Winnipeg. Dept. of Earth Sciences.
For primary bibliographic entry see Field 02A.
W69-09237

AIRBORNE REMOTE SENSING FOR GROUNDWATER STUDIES IN PRAIRIE ENVIRONMENT,
Department of Agriculture, Edmonton (Alberta). Water Resources Div.
For primary bibliographic entry see Field 07B.
W69-09239

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.

Harza Eng Co and Bauer Eng, Inc Rep to Chicago Metrop Sanit Dist, Feb 1969. 20 p, 6 fig, 1 append.

Descriptors: *Water pollution control, *Storm runoff, *Tunnels, *Water storage, *Hydrologic aspects, Storm drains, Pumped storage, Retention, Groundwater, Aquifers, Illinois, Cities, Urbanization.
Identifiers: *Chicago deep tunnel plan, Combined sewers.

The possible effects of the proposed Chicago deep tunnel urban runoff retention scheme on the water resources of northeastern Illinois were estimated by surveying the hydrogeology, surface water hydrology, and groundwater development of the area. Chicago has a combined sewer system, and storm runoff overloads cause discharge of raw sewage to waterways including recreational areas of Lake Michigan. A system of deep tunnels and protective recharge wells is proposed for temporary storage of peak combined loads. The system is expected to release treated storm runoff at a steady rate, greatly regulating the streamflow of receiving streams. High groundwater heads must be maintained to prevent loss of contaminated water from the tunnels, requiring good groundwater management practices for the entire area. (Knapp-USGS)
W69-09261

DIGITAL COMPUTER APPLICATIONS THAT FACILITATE COLLECTION AND INTERPRETATION OF GROUNDWATER DATA,
Geological Survey, Lawrence, Kans.
For primary bibliographic entry see Field 07C.
W69-09271

HYBRID COMPUTER SIMULATION OF A LOW-FLOW AUGMENTATION SUBSURFACE STORAGE SYSTEM,
For primary bibliographic entry see Field 07C.
W69-09276

NUMERICAL SOLUTIONS OF THE NAVIER STOKES EQUATION FOR FLOW THROUGH IDEALIZED POROUS MATERIALS,
University Coll. of Townsville (Australia). Dept. of Engineering.
K. P. Stark.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 635-649, 1968. 15 p, 16 fig, 3 tab, 27 ref.

Descriptors: *Groundwater movement, *Mathematical studies, *Digital computers, Approximation method, Numerical analysis, Flow, Porous media, Equations.
Identifiers: Navier-Stokes equations, Heration methods.

Solutions of the Navier-Stokes equations for flow in porous media are possible with high-speed digital computers. The solutions can give detailed information about flow characteristics, and compare well with experimental results. Numerical methods discussed include linearization, finite difference techniques, boundary condition selection, and the use of limiting equations such as Darcy's. (Knapp-USGS)
W69-09278

APPLICATION OF STATISTIC METHODS FOR SOLUTION OF STEADY AND UNSTEADY GROUNDWATER FLOW,
For primary bibliographic entry see Field 07C.
W69-09279

GROUNDWATER PROBLEMS,
Swedish Natural Science Research Council, Stockholm.
E. Eriksson, Y. Gustafsson, and K. Nilsson.
Proc Int Symp on Groundwater Problems, Oct 1966, Stockholm, Sweden, Wenner-Gren Symp Ser, Vol 11, 1968. 223 p.

Descriptors: *Water resources, *Groundwater, *International hydrological decade, *Conferences, Groundwater movement, Hydrogeology, Aquifers, Water chemistry, Water quality, Water level fluctuations, Tracers, Water pollution, Artificial recharge, Water storage, Water yield.
Identifiers: *Sweden, Groundwater development, Symposium.

Groundwater problems in Sweden are discussed in a 12-paper IHD symposium held in 1966. In Sweden over half of all domestic water is developed from groundwater, and the amount is increasing. Groundwater depletion, land subsidence, and groundwater contamination exist and may become more serious. The symposium includes the general topics of groundwater movement, groundwater storage, water availability, water-level fluctuations, hydrogeology, groundwater chemistry, tracer studies, water quality protection, and artificial recharge. (See also W69-09283 and W69-09284). (Knapp-USGS)
W69-09282

GROUNDWATER IN PRECAMBRIAN ROCKS IN SOUTHERN SWEDEN,
Lund Univ. (Sweden). Dept. of Physical Geography.
Ingemar Larsson.
Proc Int Symp on Groundwater Problems, Oct 1966, Stockholm, Sweden, Wenner-Gren Symp Ser, Vol 11, p 23-41, 1968. 19 p, 21 fig, 16 ref.

Descriptors: *Groundwater, *Fractures (Geology), *Hydrogeology, Faults (Geology), Groundwater movement, Permeability, Porosity, Structural geology, Geologic control.
Identifiers: *Sweden.

Groundwater in Precambrian gneisses and granites in southern Sweden only in faults and joints in the rock. By fabric analysis it is possible to separate two main groups of these fractures: the local pattern, syntectonic to the fold axis, and the grain fabric and the post-crystalline pattern. Within certain limits the latter may be generalized to a tectonic model. The faults and joints of the local pattern produce a very low yield of groundwater. It is shown in the paper how some of the faults and joints of the postcrystalline pattern may give a high yield of groundwater, and their relation to the tectonic model is discussed. (See also W69-09282). (Knapp-USGS)
W69-09283

TRACERS FOR GROUNDWATER INVESTIGATIONS,
Chalmers Univ. of Technology, Goteborg (Sweden). Inst. of Geology.
Gert Knutsson.
Proc Int Symp on Groundwater Problems, Oct 1966, Stockholm, Sweden, Wenner-Gren Symp Ser, Vol 11, p 123-152, 1968. 30 p, 10 fig, 1 tab, 98 ref.

Descriptors: *Tracers, *Tracking techniques, *Groundwater movement, Aquifers, Radioisotopes, Salts, Ions, Electrolytes, Dye releases, Hydrogeology, Karst, Sands, Gravels.
Identifiers: Complex ion tracers.

Tracers have been used in Sweden since 1869 to establish hydraulic connections in the ground and to determine the velocity of groundwater flow. Some organic dyes, Sulforhodamine G Extra, Rhodamine WT and under certain pH conditions also Uranine, seem to be useful as tracers for investigating groundwater flow in fractures and channels. Cation tracers are mostly adsorbed in porous media. Tracers for studying groundwater flow must be chosen from among anions and metal complexes. Thanks to the rapid development of analytical methods (atomic absorption, emission spectrography and neutron activation analysis) it is possible today to perform tracer tests using low concentrations of anions and complexes. Selective and precise measurement of low concentration of the radioisotopes can usually be carried out directly in the field. Tritiated water is a good tracer as it behaves essentially the same as normal water. But tritium is not easily detected in the field because of its very soft beta radiation. Among anions, iodide ion (NaI or KI containing I-131 and bromide ion containing Br-82) seem to be the most reliable. A disadvantage is that their half-lives are too short for most groundwater tests. Two very stable metal complexes are cobalt-cyanide containing Co-60 or Co-58 and Cr-51 EDTA complex have more suitable half-lives and have been successfully applied in many field investigations. Stable isotopes and natural radioisotopes are of great importance to obtain a general survey of the regional groundwater conditions, to determine the geographical origin, the age of water and in studying the water balance. (See also W69-09282). (Knapp-USGS)
W69-09284

DISTRIBUTION OF MINERAL WATERS IN THE GERMAN DEMOCRATIC REPUBLIC (GERMAN),
Central Geological Inst., Berlin, (East Germany).
Johannes Zieschang.
Z Angew Geol, Vol 14, No 9, p 493-497, Sept 1968. 5 p, 1 fig, 18 ref.

Descriptors: *Groundwater, *Mineral water, Water chemistry, Sodium, Ions, Chlorine, Structural geology, Hydraulic properties, Mineralogy, Water districts, Mapping.
Identifiers: *German Democratic Republic, Mineral water distribution.

About 3/4 of the territory of the German Democratic Republic contains mineralized groundwaters containing mainly Na and Cl ions. A map shows various mineralized provinces of the G.D.R. on the basis of geological, hydrochemical, and hydrological studies. To a great extent the genesis of the mineral waters of these provinces can be derived from the evaluation of the various parameters characterizing each province. (Gabriel-USGS)
W69-09285

HYDROGEOLOGICAL STUDIES FOR DRINKING WATER SUPPLY OF CRAIOVA CITY (ROMANIAN),
For primary bibliographic entry see Field 04B.
W69-09287

STRUCTURE, STRATIGRAPHY, AND HYDROGEOLOGY OF THE NORTHERN ROSWELL ARTESIAN BASIN, CHAVES COUNTY, NEW MEXICO,
Kay C. Havenor.
N Mex Bur Mines and Mineral Resources, Inst of Mining and Technol Circ No 93, 1968. 30 p, 2 fig, 6 tab, 23 ref, 2 append.

Descriptors: *Hydrogeology, *Aquifers, *Artesian wells, *New Mexico, Porosity, Saline water intrusion, Water yield, Geology, Structural geology, Faults (Geology), Geologic control, Karst.
Identifiers: *Roswell Artesian Basin (N Mex).

Structural and stratigraphic controls of the quantity and quality of waters within the northernmost part of the Roswell artesian basin were studied using outcrops, cores, samples, and electric logs. Three structural blocks named Six Mile, Roswell, and Orchard Park, are delineated. The artesian aquifer is developed in the top 1.3 of the San Andres upperunit and in the overlying Grayburg. The Queen forms the aquitard between the artesian and shallow aquifer of the Seven Rivers Formation and the overlying Tertiary - Quarternary alluvium. Structural uplift and consequent deep, irregular erosion have stripped the Artesia Group and the upper unit of the San Andres from the Roswell block. Secondary porosity enlargement has been developed in the Slaughter zone of the artesian aquifer. Reduced heads, because of regional over-appropriation, and reduced pressure, caused by locally intensive pumping on the Roswell block, relieve the retarding hydrostatic pressure on the saline waters in the regionally porous Slaughter zone and permit saline water encroachment into the Roswell block. (Knapp-USGS)
W69-09290

SUBSIDENCE IN MEXICO CITY IN RELATION TO GROUNDWATER OVERDRAFT,
Office of Hydraulic Resources (Mexico).
Ignacio Sainz Ortiz.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 665-671, 1967. 7 p, 6 fig.

Descriptors: *Mexico, *Subsidence, *Overdraft, *Groundwater, *Water resources, Topography, Economics, Population, Water storage, Water requirements, Water wells, Geology, Porosity, Pressure, Aquifers, Pumping, Water recharge.
Identifiers: Mexico City.

The author illustrates and briefly discusses the hydrologic, geologic, and hydraulic conditions which exist in the aquifers of the Mexico City area and suggests some methods for decreasing the process of subsidence. Several charts, cross sections, and curves are used to summarize the pumping and borehole data and to show that surface-water resources in the watershed are very limited and the storage and regulation facilities are scarce and expensive. The aquifers are confined by extensive layers of volcanic tuff in the hills and by thick layers of highly compressible volcanic clays in the plains; 1250 deep wells drawing 11.7 cu m/sec from groundwater sources are located in the city area and are the cause of a very serious overdraft. Subsidence over the plain of the Valley of Mexico is uneven and its intensity is a function of pore pressure and of the thickness and mechanical properties of the clay formations. (Gabriel-USGS)
W69-09297

LOCAL AND REGIONAL MINERALIZATION OF KARST GROUNDWATERS AND THEIR VARIATIONS IN THE DEVONIAN LIMESTONES OF THE RHINE SCHISTOSE MOUNTAINS,
Technische Hochschule, Aachen (West Germany).
H. R. Langguth.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 672-683, 1967. 12 p, 8 fig, 1 tab.

Descriptors: *Groundwater, *Water chemistry, *Karst, *Limestones, Water analysis, Shales, Geohydrologic units, Biological properties, Magnesium, Calcium, Hydrologic properties, Springs, Alkaline water, Hardness (Water), Carbon dioxide, Tertiary period.
Identifiers: *Western Germany, Rhine river area, Schistose mountains.

Mineralization of karst aquifers located in the Devonian limestones of Western Germany is described on the basis of geological and geochemical data. The limestones are subdivided by faults into isolated segments of relatively small catchment areas. The analysis of groundwaters present in these segments indicates that their chemical composition depends on the geological conditions and biological activities present in these geological blocks, with a regional decrease in mineralization toward the west. Under a complete cover of Tertiary rocks, the groundwaters are of variable character showing cation-exchange and reduction of some anions in passing through glauconitic layers. (Gabriel-USGS)
W69-09298

LATERAL MOVEMENT OF WATER THROUGH THE UNSATURATED ZONE OF AN UNCONFINED AQUIFER,
California Univ., Berkeley. Hydraulic Lab.
Fereidoun Mobasheri, M. Shahbazi, and D. K. Todd.
Calif Univ Water Resources Center Contrib No 106, Nov 1965. 39 p, 10 fig, 3 tab, 12 ref, 2 append.

Descriptors: *Unsaturated flow, *Aquifers, *Groundwater movement, *Model studies, *Hydraulic models, Permeability, Water table, Analytical techniques, Interfaces, Hydraulic conductivity, Moisture tension.
Identifiers: Lateral unsaturated flow.

Unsaturated lateral flow in unconfined aquifers was studied by mathematical analysis, sand-box, and sand-column model studies. The hydraulic conductivity decreased as the negative pressure of the porous media increased. The calculated equivalent depth of the unsaturated zone for the sand used in the investigation was 35 cm. The flow rate through unsaturated zone increased with a decreasing rate as the unsaturated zone depth increased while the hydraulic gradient was kept constant. The rate of lateral flow movement could also be calculated to a reasonable accuracy from flow net diagrams or the graphical integration of the area under a characteristic conductivity curve. An example of the application of the results can be shown by the determination of underflow at Cedar Springs Damsite in Southern California where flow through unsaturated zone was neglected although the average depth of the aquifer was only 12 ft. The material is predominantly medium-grained sand with lenses of gravel and cobbles. As the average depth of the aquifer is 12 ft, the lateral flow through the unsaturated zone could amount to 11% of the total lateral flow. (Knapp-USGS)
W69-09300

THE OPTIMAL YIELD OF AN AQUIFER,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 06A.
W69-09371

2G. Water in Soils

SOIL WATER MOVEMENT AS AFFECTED BY DEEP FREEZING,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 333-337, May-June 1969. 5 p, 6 fig, 16 ref.

Descriptors: *Soil water movement, *Frozen soils, *Freezing, *Infiltration, Frost action, Frost, Permeability, Frozen ground, Diffusion, Percolation, Porosity, Unsaturated flow.
Identifiers: Frozen-soil permeability.

Knowledge of water movement into and through frozen soils is needed for studying the hydrologic behavior of northern watersheds. Soil water was logged by the neutron method in both sandy and silty soils over 4 winters in southwestern Wisconsin. Bonded frost depth, which ranged from 8 to 120 cm at maximum penetration, was measured concurrently by frost probe or resistance blocks. Changes in soil water took place throughout much of the frost season, even with deep soil frost. One series of data showed that water may infiltrate and percolate through more than 60 cm of hard-frozen ground. However, frozen ground did impede percolation, causing a buildup of water in the frozen zone during spring melt. Although neutron readings increased at upper levels during the frost season, most of the increases could not be accounted for by decreases at lower levels. Thus, they appeared to result more from infiltration than from upward migration as reported by others. (Knapp-USGS)
W69-09139

ADSORPTION OF NONIONIC SURFACTANTS BY SOIL MATERIALS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
N. Valoras, J. Letey, and J. F. Osborn.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 345-348, May-June 1969. 4 p, 7 fig, 1 tab, 9 ref. Grant No 4000 (Forest Service, USDA).

Descriptors: *Adsorption, *Surfactants, *Soils, Wettability, Clays, Solubility, Wetting, Peat, Organic matter, Infiltration, Water chemistry, Water properties.
Identifiers: Micelles, Soil wettability, Water repellent soils.

The adsorption of nonionic surfactants by various soil materials from solution was measured. Most studies were on Aqua Gro and Soil Penetrant--surfactants marketed for use on soils. Aqua Gro was generally adsorbed to a greater extent than Soil Penetrant. Essentially all of Aqua Gro was adsorbed from solution until a given amount of surfactant was adsorbed after which there was only a slight increase in adsorption as the concentration in solution increased. Soil penetrant, on the other hand, was adsorbed to a lesser extent until the concentration in solution was increased to about 500 ppm. At this concentration, there was a very great increase in adsorption to a maximum value after which very little additional adsorption occurred as the solution concentration increased. Equilibrium between the soil and solution was either complete or near completion after one hour. Essentially no Aqua Gro was desorbed as the treated soil was placed in water. Some of the adsorbed Soil Penetrant went into solution as treated soil was placed in water. Since the reaction between soil and surfactant differs for various surfactants, the surfactant which would have optimum properties for a desired effect can be chosen. (Knapp-USGS)
W69-09141

IN SITU DETERMINATION OF PHYSICAL PROPERTIES OF THE SURFACE LAYER OF FIELD SOILS,
British Columbia Univ., Vancouver.
J. De Vries.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 349-353, May-June 1969. 5 p, 9 fig, 3 tab, 5 ref. Grant No A 2556 NRC (Canada).

Descriptors: *Soil moisture, *Moisture tension, *Tensiometers, *Nuclear moisture meters, Calibrations, Soil moisture meters, Soil physical properties, Moisture content, Water yield, Soil water movement, Laboratory tests, On-site tests.
Identifiers: *Soil surface layer, Water retention curve, Water retention.

A set of gamma ray attenuation vs. soil water matric potential data was obtained in situ by saturating an undisturbed block of soil, and by lowering the water level in steps and measuring the count rate through the soil and the corresponding water matric potential at each step. Relative water contents were calculated from the count rates by use of a rational calibration equation. The corresponding matric potential was measured with a low impedance tensionmeter. A partial water retention curve was plotted from these data, from which in turn the air intrusion value and the aeration porosity were inferred. It was shown that collimation is essential for measurements within the 1-cm thick surface layer, but it is not required for measurements within the bulk of a layered system. With a 5-mc cesium-137 source, a collimated beam and a 4-min counting time, the precision was 0.6% water content due only to errors associated with random emission. There was good agreement between a partial water retention curve obtained in situ and the one obtained with an outflow method in the laboratory. (Knapp-USGS)
W69-09142

MACROSCOPIC SWELLING AND HYDRAULIC CONDUCTIVITY PROPERTIES OF FOUR VERMICULITIC SOILS,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Rhoades, and R. D. Ingvalson.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 364-369, May-June 1969. 6 p, 2 fig, 5 tab, 25 ref.

Descriptors: *Hydraulic conductivity, *Expansive soils, Expansive clays, Soil water movement, Electrolytes, Ion transport, Permeability, Clays, Clay minerals, Mineralogy.
Identifiers: Vermiculitic soils.

The extent to which mixed Na, Ca electrolyte solutions affected the hydraulic conductivity and macroscopic swelling properties of 4 vermiculite soils was determined. Macroscopic swelling did not occur in the under 5 micron fraction of the soils until exchangeable-sodium-percentage (ESP) values in excess of 30 to 60 and electrolyte concentrations of less than 20 meq/liter were established. Decreases in hydraulic conductivities (HC) of soils devoid of montmorillonite did not occur at ESP values less than 50 in the absence of mechanical and chemical disaggregation. After disaggregation, decreases in HC occurred in the ESP range of 10-40 at electrolyte concentrations of 5-10 meq/liter. The concept of 'inactive exchangeable Na' residing in non-clay-sized vermiculite particles is introduced. (Knapp-USGS)
W69-09143

APPRAISAL OF RESEARCH ON SURFACE MATERIALS OF DESERT ENVIRONMENTS,
Arizona Univ., Tucson; and Army Natick Labs., Mass.
Harold E. Dregne.
IN W. G. McGinnies, B. J. Goldman, and Patricia Paylore, eds., Deserts of the World, an Appraisal of Research into their Physical and Biological Environments, p 285-377, University of Arizona Press, Tucson, 1968. 93 p, 2 tab, 481 ref.

Descriptors: *Deserts, *Synoptic analysis, Arid lands, Climates, Aeolian soils, Dunes, Soil types, Soil texture, Soil surveys, Soil physical properties, Soil moisture, Soil groups, Soil classifications, Saline soils, Soil tests, Soil analysis, Calcareous soils, Sands, Winds, Moisture availability, Soil stability, Irrigation effects, Trafficability, Soil chemical properties, Soil compaction, Soil contamination effects, Soil engineering, Soil formation, Soil surfaces, Microorganisms, Fungi, Azotobacter, Algae, Soil moisture movement, Evapotranspiration, Saline soils, Sodium, Nitrogen, Organic matter, Bibliography, Hydrogen ion concentration.
Identifiers: Atacama-Peruvian Desert, North American Desert, Termites, Hardpans, Desert pavement, Piping, Kalahari-Namib Desert, Sahara Desert, Somali-Chalbi Desert, Arabian Desert, Iranian Desert, Thar Desert, Turkestan Desert, Takla-Makan Desert, Gobi Desert, Australian Deserts, Monte-Patagonian Desert.

This paper is a survey of the state of knowledge of surface materials in the major desert regions of the world. Existing problems are emphasized and recommendations for future research are made. A resume of principal soils of each desert is presented along with a review of the pertinent literature. Tables list soil authorities and depositories of soils information, both geographically. A variety of aspects of the biological, chemical and physical properties of soils in arid and semiarid regions are discussed. Russian, French, Dutch and U.S. systems of soil classification are compared and the complications resulting from the use of multiple systems is pointed out. The duplication in classification by agricultural soil scientist and soil engineers is examined and suggestions for a unified soil nomenclature system are presented. Data is still very sparce for arid and extremely arid areas, most soils studies resulting from agricultural interests. Development of soils under arid conditions is poorly understood. Confusion in terms, such as color and group names, used to classify arid-zone soils, is a major deficiency. Soil-water ratio dilutions for pH and soluable salts are frequently not indicated in the literature, making reliable comparisons impossible. Improved methods are needed for determining soil texture, soil aggregation, exchangeable calcium and magnesium in calcareous soils, and exchangeable sodium in highly saline soils. Studies are needed in trafficability. (See W69-09206). (Sherbrooke-Ariz)
W69-09208

NUMERICAL ANALYSIS OF PONDED RAINFALL INFILTRATION,
Geological Survey, Menlo Park, Calif. Water Resources Div.
J. Rubin.
Proc Wageningen Symp on Water in the Unsaturated Zone, Int Ass Sci Hydrol Pub No 82, p 440-451, 1969. 12 p, 5 fig, 8 ref.

Descriptors: *Infiltration, *Unsaturated flow, *Soil water movement, Surface-groundwater relationships, Soil moisture, Rainfall intensity, Mathematical models, Digital computers, Permeability, Porosity, Particle size, Hydraulic gradient, Water spreading, Flooding.
Identifiers: *Ponded infiltration.

The preponding and ponded stages of rainfall infiltration were studied by solving numerically the partial differential equation of downward moisture flow in unsaturated soils. To make such a study possible, the previously developed numerical method for rain infiltration analysis was appropriately modified. The modified method was used for computing moisture content and pressure head profiles during preponding and ponded rainfall infiltration, as well as the theoretically expected rainfall infiltration rates. In particular, the dependence of the above profiles and rates upon rain intensity was studied. One of the conclusions reached was that the theoretical relations between ponded rainfall infiltration rates and infiltration duration, computed for rains of various intensities, cannot be expressed by a single curve. These relations also differ significantly from the flood-water infiltration capacity-time function. (Knapp-USGS)
W69-09264

FLOWS AND CYCLES OF MACRO- AND MICRO-ELEMENTS IN A FOREST SOIL AND ITS ENVIRONMENT,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand).
For primary bibliographic entry see Field 02K.
W69-09343

STEADY STATE STUDIES OF NITRIFICATION IN SOIL: THEORETICAL CONSIDERATIONS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02K.
W69-09345

DETERMINATION OF SOIL CATION EXCHANGE CAPACITY BY A SIMPLE SEMIMICRO TECHNIQUE,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 02K.
W69-09346

RADIATION AS A TECHNIQUE IN SOIL BIOLOGY AND BIOCHEMISTRY,
California Univ., Davis. Coll. of Agriculture.
For primary bibliographic entry see Field 02K.
W69-09350

RESPONSE OF CHEMOAUTOTROPHIC NITRIFIERS TO FOREST CUTTING,
Yale Univ., New Haven, Conn.; and Dartmouth Coll., Hanover, N.H.
For primary bibliographic entry see Field 02K.
W69-09351

2H. Lakes

MOTIONS IN A MODEL GREAT LAKE DUE TO A SUDDENLY IMPOSED WIND,
Waterloo Univ. (Ontario).
G. T. Csanady.
Journal of Geophysical Research, Vol 73, No 20, p 6437-6447, Oct 1968. 11 p, 3 fig, 5 tab, 9 ref.

Descriptors: *Greal Lakes, *Hydrodynamics, *Wind velocity, *Water waves, *Water currents, Rotational flow, Friction, Thermocline, Seiches, Coriolis force, Density stratification, Model study, Interfaces.
Identifiers: *Wind-stress system, Inertial periods, Coastal jets, Poincare waves.

A solution is presented for the initial value problem that arises when a uniform wind stress is suddenly imposed on the surface of a circular, constant depth, two-layer lake that has similar characteristics to the Great Lakes under summer conditions. Even with this minimum number of dynamically significant features in the theoretical model (closed basin, two-layer structure, and constant Coriolis parameter) a number of experimentally found features in the behavior of the Great Lakes are reproduced in a realistic way, the most important such phenomena being (1) large thermocline movements near the shores, (2) coastal jets, (3) rotary currents in the center portion, (4) standing internal waves of long wavelength and large amplitude, (5) standing surface seiches, and (6) rotating surface and internal seiches. Data and models are shown in tables and figures. (Sherman-Vanderbilt)
W69-09046

CHEMICAL AND MINERALOGICAL CHARACTERISTICS OF EUTROPHIC LAKE SEDIMENTS,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 05C.

W69-09144

THERMAL INFLUENCE OF THE LAKE INAWASHIRO ON THE LOCAL-CLIMATE IN SUMMER DAYTIME,
Tohoku Univ., Sendai (Japan). Faculty of Science.
Hiroshi Shitara.
Sci Rep of Tohoku Univ, 7th Ser (Geogr), Vol 18, No 2, p 213-220, Mar 1969. 8 p, 8 fig, 1 ref.

Descriptors: *Lakes, *Thermal properties, *Climates, Air temperature, Winds, Cloud cover, Rain, Altitude, Micrometeorology, Weather data, Weather patterns.
Identifiers: *Japan, Lake thermal effect, Lake Inawashiro.

In this paper the author summarized the results of his daytime observations conducted in 1967 and on July 10, 1968. The air temperature difference at 1.5 m-level between the windward shore and the leeside shore is larger when the wind is blowing across the lake under the clear weather. When the air-flow from the lake surface alternates with that from the inland, there is a sudden drop in the air temperature. Horizontal air temperature change on the lake is large in the windward area, in accordance with the distance from the windward shore, while it is small in the leeside area. Vertical air temperature gradient (1.5 m - 5.0 m) under clear weather is far stronger on the windward shore than on the leeside shore. Under clear weather, the characteristics with the incoming type in micro-climate is observed in the vertical air temperature profile blow 3.0 m-level, and it disappears at a location 200 meters distant from the windward shore, and appears again in the plain near the leeside shore. The air temperature difference, between the location on the lake near the windward shore free from the micro-climate on the ground and the leeside shore, is about 2.0 deg C, which is estimated as the thermal influence of the lake surface upon the local climate, within the limits of these observations. (Gabriel-USGS)
W69-09150

DEGRADATION OF GAMMA - BHC IN SIMULATED LAKE IMPOUNDMENTS AS AFFECTED BY AERATION,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05C.
W69-09227

MONTHLY SURVEY OF VITAMIN B-12 CONCENTRATIONS IN SOME WATERS OF THE ENGLISH LAKE DISTRICT,
National Inst. for Research in Dairying, Reading (England). Unit for Biochemical Research Bearing on Fish Problems.
K. W. Daisley.
Limnol and Oceanogr, Vol 14, No 2, p 224-228, Mar 1969. 5 p, 3 fig, 22 ref.

Descriptors: *Lakes, *Vitamin B, Chemical analysis, Organic matter, Nutrients, Sediments, Ecology, Algae, Seasonal, Analytical techniques, Bacteria, Mapping, Silting.
Identifiers: *England, English Lakes, Vitamin B-12.

The vitamin B-12 activity for 'Euglena gracilis' of water from 9 lakes of the English Lake District was assayed at 15 consecutive monthly intervals. Filtration through glass-fiber filters was used to differentiate between dissolved vitamin and that in gross particulate matter. The average vitamin B-12 concentrations correlated with the so-called, evolutionary series of the lakes: the primitive rocky lakes of low productivity are low in vitamin B-12 and the 'evolved' silted lakes, richer in sediments, nutrients, and organisms have higher levels of the vitamin. There is also some indication of seasonal variations at some lakes but the differences are much smaller than the seasonal algae changes. (Gabriel-USGS)
W69-09254

STUDIES ON THE DISTRIBUTION OF COBALT IN LAKES,
Wisconsin Univ., Madison. Limnology Lab.
Michael Parker, and Arthur D. Hasler.
Limnol and Oceanogr, Vol 14, No 2, p 229-241, Mar 1969. 13 p, 5 fig, 5 tab, 42 ref.

Descriptors: *Lakes, *Cobalt, Water chemistry, Seasonal, Statistical methods, Water temperature, Dissolved oxygen, Sampling, Drainage, Organic matter, Radioactivity, Conglomerate rocks, Photosynthesis, Phytoplankton.
Identifiers: Wisconsin lakes, Cobalt distribution.

Distribution of cobalt was investigated by adding cobalt-57 to bottles of lake water to see whether there was any seasonal change in the distribution of cobalt in filtrates (solutions) and seston after 24-hour incubation, or whether any differences in this distribution could be found between lakes. Several distinct patterns of seasonal distribution of Cobalt-57 between 'solution' and seston were observed but no explanation of the basic mechanism causing these changes can be offered. In general, direct biological uptake did not appear to be significant in removing Cobalt-57 from solution (Lake Mendota, Wisconsin). Photosyntheic activity was of little importance. Experiments with inhibitors and heated waters indicated the importance of nonbiological processes. Algae showed very little radioactivity. (Gabriel-USGS)
W69-09255

DISTRIBUTION OF OLIGOCHAETES IN WESTERN LAKE ERIE, 1961,
Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Lab.
Jarl K. Hiltunen.
Limnol and Oceanogr, Vol 14, No 2, Mar 1969. p 260-264, 5 p, 9 fig, 15 ref.

Descriptors: *Oligochaetes, *Lakes, *Lake Erie, Sampling, Tubificids, Estuaries, Rivers, Pollutant identification, Mapping, Runoff, Ecology, Ecological distribution.
Identifiers: Lake Erie oligochaetes.

A total of 52,390 oligochaetes were collected from 40 stations in western Lake Erie in spring 1961. The population was composed of 2 families, Naididae and Tubificidae. Only 6 species of naidids were found. One, Paranais frici, is apparently new to the list of North American freshwater Naididae. Among the 14 tubificids found, 5 species of Limnodrilus were most abundant; they contributed 90% or more of all oligochaetes at 33 of the 40 stations. Numbers of Limnodrilus were generally large near the mouths of the Detroit, Raisin, and Maumee rivers and decreased progressively lakeward. Stylodrilus heringianus, a pollution-intolerant species common in eastern Lake Erie, was not found in the western end of the lake. (Gabriel-USGS)
W69-09256

A HORIZONTAL WATER SAMPLER FOR INVESTIGATION OF STRATIFIED WATERS,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
Richard P. Howmiller, and William E. Sloey.
Limnol and Oceanogr, Vol 14, No 2, p 291-292, Mar 1969. 2 p, 3 fig, 5 ref.

Descriptors: *Sampling, *Instrumentation, *Stratification, Turbidity, Carbon, Electrical equipment, Water chemistry, Physical properties, Biological properties, Hydrologic properties.
Identifiers: Water samplers, Stratified waters.

Turbid waters frequently show physical, chemical, and biological stratification. To identify and record the data of these stratifications, a water sampler was designed. The triggering mechanism of this water sampler is similar to that used on most Ekman grabs. The sampler is designed for easy manipulation even with heavy gloves during winter sampling. The supporting line passing through the center of the triggering mechanism may continue down to support several samplers to be tripped in series. Two years of intensive year-round sampling have shown no malfunction with this sampler. (Gabriel-USGS)
W69-09257

QUATERNARY LAKES OF EASTERN BRAZIL,
Heidelberg Univ. (West Germany). Geological-Paleontological Inst.
R. Pflug.
Photogrammetria, Vol 24, No 1, p 29-35, Feb 1969. 7 p, 3 fig, 5 ref.

Descriptors: *Aerial photography, *Geomorphology, *Lakes, *Pleistocene epoch, Sedimentation, Dams, Erosion, Flood plains, Rivers, Terrain analysis, Topography.
Identifiers: *Brazil, Rio Doce River.

In the middle course of the Rio Doce, an eastern Brazilian river approximately 700 km long, occur hundreds of dammed valley lakes. These lakes are restricted to a hilly terrain which accompanies the river in a width of more or less 20 km. The lakes, whose water levels now stand about 20 m above the Rio Doce, were formed during a semi-arid cycle. According to a preliminary C-14 determination (14,160 plus or minus 500 years) this cycle corresponds to the last ice age of the Northern Hemisphere. The process of formation of these lakes, deducible from the interpretation of aerial photographs, was damming of clear tributary streams by the aggrading Rio Doce during the late Pleistocene epoch, followed by recent downcutting of the river. (Knapp-USGS)
W69-09260

AN ISOTOPE SURVEY OF LAKES IN THE KARST REGION OF SOUTHERN TURKEY,
International Atomic Energy Agency, Vienna (Austria).
Turgut Dincer, and Bryan R. Payne.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 654-661, 1967. 8 p, 5 fig, 1 tab.

Descriptors: *Radioisotopes, *Lakes, *Radiochemical analysis, *Karst, Geochemistry, Turnovers, Oxygen, Hydrogen, Chloride, Hydrogen ion concentration, Tritium, Sinks, Hydrological properties, Precipitation (Atmospheric), Drainage, Water balance, Runoff, Limestones, Spring waters.
Identifiers: *Turkey, Mediterranean coast, Central Anaitolia, Egridir and Beysehir Lakes.

Some lakes located in the Karst region of southern Turkey were investigated for the presence of stable and radioactive isotopes of hydrogen and oxygen. The study shows that on the basis of chloride concentration these shallow lakes may be assumed to be well-mixed reservoirs and the turnover time can be estimated by comparing actual tritium concentration curves with theoretical curves based on tritium fallout in the region. The turnover time in turn gives some information concerning losses taking place through sinkholes. The article contains a description of the lakes, an explanation of the water balance, a reconstruction of the tritium fallout curves, and explains the interpretation of data. (Gabriel-USGS)
W69-09295

WIND-DRIVEN SUMMER CIRCULATION IN THE GREAT LAKES,
Waterloo Univ. (Ontario).
G. T. Csanady.
Journal of Geophysical Research, Vol 73, No 8, p 2579-2589, April 15, 1968. 3 fig, 9 ref.

Descriptors: *Great Lakes, *Water circulation, *Water currents, Hydrology, Thermocline, Density stratification, Wind, Kinetics, Friction, Model study, Lakes.
Identifiers: *Wind-driven circulation, *Radius of deformation, *Wind-stress system, Barocline, Barotrope.

Simplified models of wind-forced motions are considered in the two-layer circular basin 'model Great Lake' introduced in an earlier paper. Under summer conditions, when a thermocline is present, both a uniform, steady wind and a uniform wind varying periodically in time produce a frictionless lake response characterized by strong boundary currents and pronounced thermocline movements in the shore zone. The length scale determining the width of this shore zone is the 'radius of deformation', typically three miles. Observations on Lakes Huron, Michigan, and Ontario show such motions to be present near the shores. (Sherman-Vanderbilt)
W69-09308

LARGE-SCALE MOTION IN THE GREAT LAKES,
Waterloo Univ. (Ontario).
G. T. Csanady.
Journal of Geophysical Research, Vol 72, No 16, p 4151-4162, Aug 15, 1967. 4 fig, 1 tab, 24 ref.

Descriptors: *Great Lakes, *Density stratification, *Thermocline, *Water circulation, *Hydrodynamics, *Water currents, *Coriolis force, *Hydrostatic pressure, Continuity equation, Model studies, Limnology, Rotational flow, Lakes.
Identifiers: *Large-scale motion, *Rossby number, Coastal jets, Kelvin waves.

Large-scale motion in the Great Lakes can be assumed to be of small Rossby number, so that the equations of motion can be linearized and at the same time the variation of the Coriolis parameter with latitude can be neglected. When applied to a two-layer lake model, the equations of motion and the continuity equations can be reduced to two independent sets of equations for the principal 'internal' and 'surface' modes. When applied to a circular basin, constant depth 'model Great Lake' (of dimensions and other characteristics appropriate to the Great Lakes) the theory suggests the existence of (1) baroclinic coastal jets during the summer stratification; (2) slow counterclockwise rotating internal waves of a period many times the half-pendulum day; and (3) surface and internal seiches rotating in either direction and having a period of at most several hours (surface modes) or up to within a small fraction of the inertial period (internal modes). An examination of the available observational material indeed suggests that these features are detectable in the Great Lakes. (Sherman-Vanderbilt)
W69-09310

WIND-DRIVEN CIRCULATION IN UNSTRATIFIED LAKES,
Scripps Institution of Oceanography, La Jolla, Calif.
John A. T. Bye.
Limnology and Oceanography, Vol 10, No 3, p 451-458, 1965. 3 fig, 1 tab, 10 ref.

Descriptors: *Water circulation, *Wind velocity, *Water currents, *Flow profiles, *Lakes, *Reynolds number, Theoretical analysis, Limnology, Air-water interfaces, Laboratory tests, Hydrology, Turbulence.
Identifiers: Unstratified lakes, Wind-driven circulation.

Observations of the wind-driven circulation in the vertical plane of unstratified lakes, including some new results indicating a logarithmic current profile near the lake surface, are presented. The current profile was deduced from the varying velocities of floats of different lengths at wind speeds less than 15 m/sec and found independent of wave action. The velocity profile has not been measured in lake conditions except at a depth of one meter, but in laboratory observations it has the features that (1) the velocity and velocity gradients are large near the surface, and (2) near the bottom there is a thin layer where the return current is reduced to zero. A theoretical velocity profile that is in fair agreement with a stressdriven laboratory flow, and that may approximate to the steady circulation in the central section of lakes of nearly uniform depth, is developed. From this profile, an estimate is made of the effect on the wind setup of a gentle sloping lake bottom. (Sherman-Vanderbilt)
W69-09314

EUTROPHICATION OF THE ST. LAWRENCE GREAT LAKES,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
For primary bibliographic entry see Field 05C.
W69-09315

ZINC-65 IN STUDIES OF THE FRESHWATER ZINC CYCLE,
Michigan Univ., Ann Arbor. Dept. of Zoology.
Roger W. Bachmann.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash, DC, Schultz, Vincent and Klement, Jr, Alfred W (Eds), p 485-496. 7 fig, 9 tab, 53 ref.

Descriptors: *Zinc radioisotopes, *Freshwater, Michigan, Lakes, Tracers, Detritus, Sediments, Seston, Daphnia, Mayflies, Adsorption, Mathematical models, Aquatic plants, Chelation, Synthesis, Enzymes, Algae, Sampling, Radioactivity, Hydrogen ion concentration, Temperature, Alkalinity, Zooplankton, Benthic fauna, Calcium, Magnesium, Potassium, Sodium, Phytoplankton.
Identifiers: *Zinc cycle, Ann Arbor (Mich), Golenkinia paucispina, Daphnia pulex, Daphnia magna, Ephemera simulans, Suspended materials, Inorganic complexes, Elodea canadensis, Ceratophyllum demersum, Potomogeton richardsonii, Ankistrodesmus, Radionuclide uptake.

Author determined quantitatively some of the factors affecting distribution of zinc between the water and various solid materials in lakes. The uptake of zinc by suspensions including Golenkinia paucispina, organic detritus, lake sediments, and natural lake seston was measured with zinc-65, as tracer; and zinc uptake by Daphnia pulex and Daphnia magna was followed. Daphnia pulex takes up zinc primarily from particles to which zinc is adsorbed. When nymphs of Ephemera simulans were present, the zinc was mixed into sediments and approached a uniform distribution. Nymphs did not accumulate a significant fraction of zinc available. Theoretical curves were derived predicting zinc distribution between liquid and solid phases in lakes as a function of total zinc content and suspended material mass. A theoretical outline of the freshwater zinc cycle was then presented, characterized by exchanges between dissolved zinc and various organic and inorganic suspended materials, including rooted aquatic plants and bottom sediments. Transfer of zinc to sediments by sedimentation of adsorbents seem to be a mechanism for removal of the ion from lake waters. Accumulation of zinc in sediments should result. Formation of organic chelates and inorganic complexes may be factors altering the scheme proposed. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09332

CONTROL OF MIXED-SUBSTRATE UTILIZATION IN CONTINUOUS CULTURES OF ESCHERICHIA COLI,
Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
For primary bibliographic entry see Field 02K.
W69-09341

THE PHOSPHORUS FRACTIONS AND THE TURNOVER TIME OF INORGANIC PHOSPHORUS IN DIFFERENT TYPES OF LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
F. H. Riger.
Limnology and Oceanography, Vol 9, No 4, p 511-518, 1964. 2 fig, 4 tab, 16 ref, disc.

Descriptors: *Lakes, *Phosphorus compounds, *Phosphorus, Limnology, Seston, Seasonal, Plankton, Cycling nutrients, Phosphorus radioisotop Hydrogen ion concentration, Hardness, Colc Stratification, Eutrophication, Analytical method
Identifiers: *Lake typology, *Turnover tim Phosphorus (Inorganic), Phosphorus (Soluble organic), Phosphorus (Colloidal), Phosphorus (Soluble reactive), Phosphorus (Total), Millipore filtration, Toronto (Ont), Algonquin Provincial Park (Ont), Canada, Ontario, Lake size, Urban drainage, Bog lakes, Grenadier Pond (Ont), Heart Lake (Ont), Teapot Lake (Ont), Mary Lake (Ont), Eos Lake (Ont), Costello Lake (Ont), Opeongo Lake (Ont), Lake of Two Rivers (Ont), Found Lake (Ont).

Author reports concentrations of inorganic phosphorus (P), soluble organic P, and seston P, studied throughout one year in nine Ontario lakes, differing in size total P concentration, and water color. Percentages of total P occurring as soluble organic P were similar in eight lakes (range: 25.0-31.7%), and divergent (12.5%) in extremely eutrophic Grenadier Pond, which receives urban drainage. Author accounts for differences between his results and those reported in the literature by others as due to varied techniques used, and presents experimental evidence to support this view. Millipore filtration (pore diameter: 0.1 micron) reduced soluble organic fraction to 18% of total P. Turnover time of inorganic P was less than 10 minutes in all lakes during summer, but increased in winter (in Heart and Mary Lakes, by as much as three orders of magnitude). Report presents experimental data to show that use of unwashed Millipore filters adds P to filtrate. (Eichhorn-Wis)
W69-09342

WATER-QUALITY MANAGEMENT AND LAKE EUTROPHICATION: THE LAKE WASHINGTON CASE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05G.
W69-09349

ON THE CONSEQUENCES WHICH LOWERINGS OF THE WATER LEVEL FOR AGRICULTURAL PURPOSES HAVE ON MACROPHYTIC AND PLANKTONIC COMMUNITIES OF SHALLOW LAKES WITHIN THE OLIGOTROPHIC AREA OF SOUTH SWEDEN, (GERMAN),
Lund Univ. (Sweden). Limnological Inst.
Sigvard Lillieroth.
Acta Limnologica 3, 1950, Carl Bloms Boktryckeri, Lund, Sweden. 288 p, 64 fig, 26 tab, 158 ref.

Descriptors: *Eutrophication, *Lakes, *Phytoplankton, Shallow water, Nutrients, Plankton, Water levels, Water level fluctuations, Aquatic plants, Drainage effects, Drawdown.
Identifiers: *Sweden, *Macrophytes, *Auxotrophication, Phragmites, Scirpus, Typha, Equisetum fluviatillis, Gyttja.

The biomass of aquatic vegetation was studied in five shallow lakes located in an limnologically uniform area of glacial deposits. The water level of three of these lakes was lowered from 1.2 to 2.0 meters by artificial drainage of surrounding wet lowlands. This amelioration induced an increase of nutrients for both macrophytes and microphytes. The increased fertility of the lakes was particularly reflected in the colonization of available areas of gyttja by gramineous communities, largely those of Phragmites, Scirpus, Typha, and Equisetum fluviatile. The eutrophication of the lakes was interpreted as 'auxotrophication,' a term implying an augmented productive capacity of the basin due to either an increase in concentration of soluble salts, or a mobilization of previously unutilized latent supply of nutrients. (Wilde-Wis)
W69-09352

2I. Water in Plants

CO sub 2 - GAS EXCHANGE AND WATER RELATIONS OF PLANTS IN THE NEGEV DESERT AT THE END OF THE DRY PERIOD,
Hebres Univ., Jerusalem (Israel).
O. L. Lange, W. Koch, and E. D. Schulze.
Ber. Deutsch Botan Gesell, bd 82, hft 1/2, p 39-61, 1969. 23 p, 19 fig.

Descriptors: *Moisture stress, *Photosynthesis, *Arid climates, Deserts, Arid lands, Drought resistance, Heat resistance, Physiological ecology, Plant physiology, Stomata, Transpiration control, Water.
Identifiers: Israel, Negev Desert, CO sub 2.

The aim of this study was the clarification of how different plants survive the dry period and to what extent positive net-photosynthesis under high water stress is possible. In order to investigate the gas exchange under the most natural conditions, the experimenters used the Siemens gas-exchange chamber with temperature and humidity control. This control allowed elimination of the glasshouse effect. Daily net-photosynthesis and transpiration were determined under natural diurnal course conditions. In addition, a number of experiments were performed in order to analyze the effect of the temperature, independent from the ambient. Under natural conditions, the diurnal course of net-photosynthesis varies in number and form of peak according to the species. It was shown that increased resistance as well as the mid-day closing of the stomata are brought about directly by the temperature. This reaction, temperature species specific, protects the plant against further impairment of its already stressed water conditions. The same leaf temperature in the presence of different water contents can have an entirely different effect, temperature sensitivity being increased with a corresponding water stress. The daily balance of the net-assimilation and the assimilation-transpiration quotient of several wild and cultivated plants are compared. Perennial desert xerophytes are able to stabilize their water relations in a manner that allows them to maintain positive daily balance of the CO sub 2 gas exchange even at the end of the period. (Sherbrooke-Ariz)
W69-09204

REVEGETATION PROCEDURES FOR IMPROVEMENT OF THE SAN SIMON WATERSHEDS,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 04D.
W69-09205

2J. Erosion and Sedimentation

STUDY OF EROSION PHENOMENA AND UNCONSOLIDATED DEPOSITS IN BAIE-SAINT-PAUL-SAINT-URBAIN AREA, CHARLEVOIX COUNTY,
Department of Natural Resources, Quebec. Geological Exploration Service.
Jean-Y. Chagnon.
Geol Explor Serv, Quebec Dep Natur Resources Spec Pap No 3, 1969. 29 p, 6 fig, 8 plate, 8 ref.

Descriptors: *Erosion, *Sediments, *Topography, *Deposition (Sediments), Drainage, Bedrock, Rivers, Geology, Quaternary period, Glaciation, Gravels, Sands, Clays, Lakes, Rain, Remedies, Erosion control, Landslides.
Identifiers: *Canada, Quebec, Charlevoix County.

This report presents a study of unconsolidated sediments in Charlevoix County, Quebec, with a special reference to the erosion phenomena taking place along the Gouffre River. The results of the erosive processes are evident at numerous points along the Gouffre River Valley. Landslides, riverbank erosion, solifluction, and reptation phenomena are abundant, and the river causes considerable damage to the riparian farms. The report describes the topography, drainage, bedrock, and geology of unconsolidated deposits and suggests some methods to control the erosive processes taking place in the Baie-Saint-Paul-Saint-Urbain Area. (Gabriel-USGS)
W69-09151

THE BEHAVIOR OF STRAIGHT OPEN CHANNELS WITH MOVABLE BEDS,
Geological Survey, Washington, D.C.
Thomas Maddock, Jr.
Geol Surv Prof Pap 622-A, p A1-A70, 1969. 70 p, 52 fig, 3 tab, 60 ref.

Descriptors: *Alluvial channels, *Sediment transport, *Channel morphology, Open channel flow, Regime, Sedimentation, Model studies, Hydraulic models, Hydraulics, Bed load, Particle size, Particle shape.
Identifiers: Alluvial channel behavior.

The chief variables related to the behavior of alluvial channels are mean velocity, depth, width, slope, quantity of sediment transport, and sediment size composition. Because changes in one variable result in mutual adjustment of all other variables, the actual results depend on the constraints that may be imposed, either natural or artificial. Analysis of flume data indicates that no single simple equation describes the relation between mean velocity and load, the sediment discharge per foot of width of channel. Different equations for unigranular sediment and for sediment mixtures are proposed. These equations are based on flume data and are tested with data collected in the field. (Knapp-USGS)
W69-09155

THE LACUSTRINE BEDS OF WADI FEIRAN, SINAI: THEIR ORIGIN AND SIGNIFICANCE,
Geological Survey of Israel, Jerusalem. Hydrogeology Div.
A. Issar, and Y. Eckstein.
Israel J Earth-Sci, Vol 18, No 1, p 21-27, 1969. 7 p, 11 fig, 9 ref.

Descriptors: *Lake beds, *Arid lands, *Sedimentation, Sediments, Deposition (Sediments), Erosion, Sediment transport, Paleolimnology, Paleoclimatology, Pleistocene epoch.
Identifiers: Israel, Sinai.

Wadi Feiran and its tributaries, Sinai, dissect a series of yellowish silts and clays interbedded with minor sands and gravels. They are considered to originate from local lacustrine or swampy conditions, which were intermittently disrupted by violent floods. Deposits of several such ancient shallow lakes or swamps were observed at different topographic levels, separated by natural barriers of resistant dikes. The lakes are thought to have been formed during late Plio-Pleistocene times, when more humid climatic conditions prevailed. (Knapp-USGS)
W69-09156

THE GEOCHEMISTRY OF MOLYBDENUM IN THE BLACK SEA,
Akademiya Nauk SSSR. Institut Okeanologii.
M. F. Philipchuk, and I. I. Volkov.
Transl from Russian Litologiya i Polezn Iskop, No 4, p 5-27, July-Aug 1968. Lithology and Mineral Resources, No 4, p 389-407, July-Aug 1968. 19 p, 8 fig, 7 tab, 43 ref.

Descriptors: *Geochemistry, *Molybdenum, *Sediments, *Sea water, *Bottom sediments, Diagenesis, Organic matter, Sulfides, Pyrite, Mudflows, Basalts, Coals, Oxidation, Erosion, Clays, Muds, Silts.
Identifiers: *Black Sea, Sediment redistribution.

Distribution of molybdenum in the surface layer and in a vertical section of the Black Sea sediments was investigated by analyzing for molybdenum, hydrogen sulfide, organic carbon, and calcium carbonate contents. It was established that Mo content of the sea water varies from 0.5 to 6.4 micrograms per liter whereas the Mo in the surface layer varies with type of layer sediment. In the vertical section of the bottom sediments, maximum concentration of Mo, which is up to 200 ppm, is limited to the Old Black Sea deposits (sapropelic coals) enriched in organic material and reduced sulfur compounds (pyrite, organic sulfur). Muddy water data indicate a very high mobility of Mo in diagenesis. (Gabriel-USGS)
W69-09161

CHARACTERISTICS OF SEDIMENTATION ON THE SHELF OF SOUTHWESTERN AFRICA,
Atlantic Scientific Res Inst. of Fisheries and Oceanogr., Kaliningrad (USSR).
Yu. M. Senin.
Transl from Russian Litologiya i Polezn Iskop, No 4, p 108-111, July-Aug 1968. Lithology and Mineral Resources, No 4, p 476-479, July-Aug 1968. 4 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Sedimentation, *Marine geology, *Atlantic Ocean, *Continental shelf, Arid climates, Weathering, Runoff, Nutrients, Ocean currents, Biomass, Zooplankton, Phytoplankton, Temperature, Water chemistry, Silts, Clays, Phosphorus, Sands.
Identifiers: *Africa, Shelf sediments.

Results of studies of 180 bottom samples of continental shelf sediments from southwestern Africa, collected in 1963-1964, are presented. The examples were analyzed by using microscopic, granulometric and chemical methods. In general the hydrologic conditions of this shelf (in an arid climate) are determined by the complex interaction of the waters of the cold Benguela Current, the warm and saline waters of a southern current and deep waters which upwell onto the shelf. The dynamic regime of the shelf is characterized by considerable activity; the speed of the Benguela Current is about 25 cm/sec. and the speed of ebb-and-flow tides is 25 cm/sec. The climatic and hydrochemical characteristics of the region are clearly reflected in the physical and chemical compositions of the bottom sediments and in the distribution of their granulometric and physical genetic types. One of the characteristics of the shelf sediments is the widespread occurrence of terrigenous, diatomaceous, and glauconitic sediments, where the formation of diatomaceous oozes and glauconitic sands is obviously related to the strong constant upwelling of cold deep waters. (Gabriel-USGS)
W69-09162

PEBBLE ORIENTATION IN A RECENT GRAVEL CHANNEL,
Akademiya Nauk SSSR. Sibirskoe Otdelenie. Institut Geologii i Geofiziki.
V. I. Levin.
Transl from Russian Litologiya i Polezn Iskop, No 4, p 126-130, July-Aug 1968. Lithology and Mineral Resources, No 4, p 497-500, July-Aug 1968. 4 p, 2 fig, 2 tab, 5 ref.

Descriptors: *Gravels, *Streamflow, *Erosion, *Deposition (Sediments), Gold, Mining, Conglomerate rocks, River beds, Mathematical studies, Statistical methods, Currents (Water).
Identifiers: *Gravel channel, Pebble orientation, Yakutia (Siberia).

Pebble orientations in a small gravel channel of the Mulam River (southern Yakutia) were investigated and the results plotted as the petrofabric diagrams of elongate-flattened and rod-shaped pebbles. An elongate-flattened pebble generally has its maximum projection area dipping upstream with its long 'a' axis crosswise to the current; at the sides of the stream the long axis of the rod-shaped and

pear-shaped pebbles usually has the same orientation as the 'a' axis of the elongate-flattened pebbles and in the center it is generally parallel to the current with a tendency to dip downstream. The paleoconstruction of a water current may be achieved by comparing the orientation of the 'a' axes of elongate-flattened and rod-shaped or pear-shaped pebbles. (Gabriel-USGS)
W69-09163

MATHEMATICAL ESTIMATE AND SELECTION OF OPTIMAL CONDITIONS OF GRANULOMETRIC ANALYSIS BY THE HYDRAULIC METHOD,
A. A. Guseinov, and N. I. Dyudneva.
Transl from Russian Litologiya i Polezn Iskop, No 4, p 148-153, July-Aug 1968. Lithology and Mineral Resources, No 4, p 521-526, July-Aug 1968. 6 p, 1 fig, 2 tab, 10 ref.

Descriptors: *Mathematical studies, *Mathematical models, *Clays, *Settling velocity, *Hydraulic models, Velocity, Stokes law, Hydraulic properties, Sedimentation.
Identifiers: *Granulometric analysis, Clay particle settling.

The purpose of this brief article is to give an account of the separation of clay fractions, estimation of the hydraulic method of granulometric analysis, and the selection of the optimal condition for maximum preservation of particles with a diameter less than 0.01 mm. The rate of settling was investigated by using the Stokes formula modified by B. V. Arkhangel, Skiy (1935) and several decantations. It was found that one isolated particle settles more rapidly than a group of interacting particles; particles of diameter 0.01-0.05 mm have a velocity scattering of 50%, and particles of diameter 0.05-0.1 mm, 20%. This indicates a decrease of particle interaction with an increase of diameter. The All Union Research Institute method of granulometric analysis was found to be the most reliable for bed correlation since losses of particles of the limiting diameter in this case are minimized. The article discusses the sources of possible errors in studying the settlement of particles under still-water conditions. (Gabriel-USGS)
W69-09164

THE LENGTH OF RIVER-BED CONSOLIDATION DOWNSTREAM FROM DAMS (ROMANIAN),
Institute of Hydrotechnical Research, Bucharest (Rumania).
Ernest Razvan.
Hidrotechnica, Gosp Apelor, Meteorol, Vol 13, No 5, p 219-226, May 1968. 8 p, 9 fig, 4 tab, 9 ref.

Descriptors: *Scour, *Dams, *River beds, River training, Engineering structures, Turbulent flow, Bank erosion, Bank stabilization, Particle size, Froude number, Coriolis force, River basins, Rivers, Hydraulic properties, Roughness (Hydraulic).
Identifiers: *Romania, River bed consolidation.

All dams built in the 18th century in Romania had no provision for consolidation below the dam. Most of these dams were either abandoned or modernized. A dissipation basin was designed to retain the water at the dam foot for any variation of water level downstream. This paper discusses the theoretical consideration which needs to be taken for downstream consolidation. Coriolis force, Froude number and other hydraulic conditions are discussed. It is recognized that the movement of noncohesive bed particles by a macio-turbulent flow is different from the movement of particles in a normal turbulent flow. Critical velocity of bed material depends on the specific density, equivalent diameter, relative roughness, and intensity of macroturbulence. The initial movement of particles is related to the frontal hydrodynamic force, upward lifting force, and friction force. The length of consolidation and depth of scouring downstream from dams are recommended measures in preventing the uncontrolled erosion of river banks and watercourses. Graphical and mathematical models for their computation are given. (Carstea-USGS)
W69-09165

LINDANE ADSORPTION BY LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05B.
W69-09167

INVESTIGATIONS OF UNSTEADY WATER FLOW AND RIDGE-LIKE SEDIMENT DISPLACEMENT (RUSSIAN),
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W69-09173

REGIME, THEORY, AND CALCULATION AND MEASUREMENT METHODS OF SEDIMENTATION AND WATER RUNOFF (RUSSIAN),
For primary bibliographic entry see Field 02E.
W69-09174

CALCULATION OF THE AMOUNT OF LITTORALLY DRIFTED SAND,
Latgiproprom Planning Inst.
R. Ya. Knaps.
Transl from Okeanologiya, Akad Nauk, SSSR. Oceanology, Vol 8, No 5, p 680-687, 1968. 8 p, 2 fig, 19 ref.

Descriptors: *Coasts, *Beaches, *Sands, *Sediment transport, *Waves (Water), *Littoral drift, Deposition (Sediments), Currents (Water), Winds, Surf, Ocean currents.
Identifiers: USSR, Wind energy calculations.

Shallow sandy coasts are liable to large-scale littoral drifting, largely as a result of currents caused by storms. Wave action causes roiling at the bottom and the waves themselves carry considerable energy into the inshore area. A large part of the energy is dissipated in the breaker zone and a further part is imparted to currents flowing in directions very different from that of the waves. Wave methods do not offer much promise for calculating littoral drift on sandy coasts. Examples are given which confirm this. The best methods of calculating the movement of drift sand are wind-energy methods, which take account of the combined effects of wind, currents and waves. (Knapp-USGS)
W69-09180

DYNAMICS OF THE BEACH OF THE KILIYA ARM OF THE DANUBE DELTA,
Odessa State Univ. (USSR). Geology of Coast of Seas and Reservoirs.
Yu. D. Shuyskiy.
Transl from Okeanologiya, Akad Nauk, SSSR. Oceanology, Vol 8, No 5, p 687-692, 1968. 6 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Beaches, *Sediment transport, *Deltas, Waves (Water), Currents (Water), Rivers, Streamflow, Alluvium, Aggradation, Geomorphology, Littoral drift.
Identifiers: *USSR, *Danube delta.

The Kiliya arm of the Danube delta is a very youthful geological formation. Its development is very rapid, particularly in those areas where the largest volume of river sediment is deposited and where wave action is light. As a result, as shown by field investigations and an analysis of cartographic material, the northern and southern portions of the delta advance most rapidly, while the central portion is relatively steady. This pattern of development agrees well with earlier schemes of the evolution of the delta. It is also important to shipping interests. Since the distribution of alluvium on the beach depends on the dynamics of the beach deposits, vectors of sediment-moving forces were plotted by the Shishov-Knaps-Pravotorov method. The character of these vectors is quite consistent with the geomorphology of the beach and substantiates the general opinion on the direction of beach drifting. (Knapp-USGS)
W69-09181

STOCHASTIC MODEL FOR THE DEPOSITION OF VARVES IN GLACIAL LAKE BARLOW-OJIBWAY, ONTARIO, CANADA,
Geological Survey of Canada, Ottawa (Ontario).
F. P. Agterberg, and I. Banerjee.
Can J Earth Sci, Vol 6, No 4, Part 1, p 625-651, Aug 1969. 27 p, 15 fig, 5 tab, 49 ref.

Descriptors: *Sedimentation, *Varves, *Statistical models, Stochastic processes, Markov processes, Annual, Beds, Seasonal, Clays, Silts, Sands, Deposition (Sediments), Glaciation, Glacial drift.
Identifiers: Canada, Ontario.

Various methods of time series analysis have been applied to thickness data obtained from eight measured sequences of varves belonging to the Pleistocene glacial Lake Barlow-Ojibway in northern Ontario. Both sedimentological evidence and the results of the statistical analysis support Kuenen's model for varve deposition by turbidity currents. Proximally, individual varves merge with the crossbedded deltaic sands and gravel of eskers. Distally, they change successively from sandy to silty, and then to diamictic facies. Both the silt (summer) and the clay (winter) layers in a varve couplet show an approximately exponential decrease in thickness away from the icefront. This trend is more conspicuous in the silt. The genetic difference between the silt (deposited by turbidity currents) and the clay (deposited out of suspension) is reflected in marked differences in the statistical behavior of their thickness-time series. The thickness variations of both silt and clay layers can be considered as the sum of a gradual, systematic variation (signal) and a random variation (noise). When the effect of the thinning away from the icefront and that of the superimposed noise are eliminated, both the silt and clay residual thickness data satisfy a Markov model of the second order. This model is shown to be related to variations in the rate of retreat of the icefront. Besides the second order Markov process, two weakly-developed short-term cycles have also been detected. (Knapp-USGS)
W69-09238

SEDIMENTATION IN UPPER ARROW LAKE, BRITISH COLUMBIA,
Geological Survey of Canada, Calgary (Alberta).
R. J. Fulton, and M. J. L. T. Pullen.
Can J Earth Sci, Vol 6, No 4, Part 1, p 785-791, Aug 1969. 7 p, 7 fig, 2 ref.

Descriptors: *Sedimentation, *Deltas, *Lakes, *Columbia River, Beds, Deposition (Sediments), Rivers, Sedimentary structures, Turbidity currents.
Identifiers: *Canada, British Columbia, Arrow Lake.

Two rivers, the Columbia and the Incomappleux, empty into the north end of Upper Arrow Lake. The form and the general pattern of sedimentation of the two river deltas were determined by an echo sounder survey. The t hree classical delta sedimentation zones were recognized and observations made on sedimentation in each. Sedimentation in the topset zone is largely channel and overbank deposition similar to that taking place on river floodplains. The bottomset zone receives fine silt and clay carried out to where it can settle under lacustrine conditions. The bulk of the sediment is deposited at the river mouths near the top of the foreset zone. Following initial deposition, the sand and silt dumped at the river mouths is carried into the lake basin by a slow sliding failure of the entire foreset zone. (Knapp-USGS)
W69-09240

RADIOACTIVE METHODS FOR THE QUANTITATIVE DETERMINATION OF COASTAL DRIFT RATE,
Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
For primary bibliographic entry see Field 07B.
W69-09247

THE DETRITAL MINERALOGY OF OCEAN FLOOR SURFACE SEDIMENTS ADJACENT TO THE ANTARCTIC PENINSULA, ANTARCTICA,
Florida State Univ., Tallahassee. Dept. of Oceanography; and Florida State Univ., Tallahassee. Dept. of Geology.
Dennis S. Edwards, and H. Grant Goodell.
Marine Geol, Vol 7, No 3, p 207-234, June 1969. 28 p, 23 fig, 2 tab, 42 ref.

Descriptors: *Sediments, *Antarctic ocean, *Mineralogy, Provenance, Geology, Sediment transport, Ice, Currents (Water).
Identifiers: Antarctic ocean sediments.

The detrital mineralogy of the 62-125 micron size fraction of the marine sediments adjacent to the Antarctic Peninsula delineates 3 sedimentary mineralogical provinces. Western Weddell Sea sediments are dominated by a suite of metamorphic minerals which probably originates along the southern coast of the Weddell Sea. The sediments of the eastern Bellingshausen Sea are composed of a granitic suite originating largely from the rocks of the Andean intrusive, which dominates the geology of the Antarctic Peninsula. The sediments surrounding and to the north of the South Shetland Islands overwhelmingly consist of a volcanic extrusive suite derived from the insular volcanism. Ice rafting is considered the primary mode of transport, although in rare instances deep currents appear to have concentrated heavy minerals into placer or lag deposits. (Knapp-USGS)
W69-09248

SOUTH PACIFIC SEDIMENT DISTRIBUTION,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
M. Ewing, R. Houtz, and J. Ewing.
J Geophys Res, Vol 74, No 10, p 2477-2493, May 15, 1969. 17 p, 16 fig, 29 ref.

Descriptors: *Sediment distribution, *Pacific Ocean, *Seismic studies, *Marine geology, Trenches, Climatic zones, Structural geology, Velocity, Bottom sediments, Water circulation, Buoys, Detritus, Biological properties, Diatoms, Clays, Turbidity currents, Gravity, Antarctic Ocean.
Identifiers: *Sediment isopach map, Sea-floor spreading.

This paper gives sediment distribution, a sediment isopach map, velocity-depth curve, and several seismic profile sections based on seismic profiler data from about 200,000 km of tranverse in the South Pacific. The data reveal in some detail the marginal trench sediments and the sediments of equatorial and subsequatorial zones. Recent sea-floor spreading is indicated by an abrupt thinning of sediments near the crest of the Pacific-Antarctic ridge, with the spreading, it seems, related to possible large-scale vertical movements in Melanesia. The sediment distribution, except near the mid-ocean ridge, in subantarctic waters, seems to depend mainly on the effects of a former northerly location of the polar front and on modern bottom currents. (Gabriel-USGS)
W69-09251

THE CONCENTRATIONS OF LITHIUM, POTASSIUM, RUBIDIUM AND CESIUM IN SOME WESTERN AMERICAN RIVERS AND MARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02K.
W69-09281

A CONCEPTUAL MODEL OF KARSTIC EROSION BY GROUNDWATER,
Water Planning for Israel Ltd., Tel Aviv.
S. Mandel.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 662-664, 1967. 3 p, 7 ref.

Descriptors: *Erosion, *Karst, *Groundwater basins, *Groundwater movement, Solubility, Channels, Springs, Aquifers, Isotropy, Porosity, Hydrologic properties, Water levels, Limestones, Fissures (Geology), Water types, Water table, Topography.
Identifiers: *Israel, Karstic erosion.

This article is a generalized description of the process of karstic erosion by groundwater mainly based on earlier investigations of the karstic areas in Israel. The author assumes that in saturated zones of calcareous aquifers the process of erosion by solution proceeds at a very slow pace and consists of two correlated phenomena. The phenomena are: (1) solution channels are formed and widened in the vicinity of springs where a strong flow-concentration occurs; and (2) an intricate system of solution channels develops, the dominant characteristic of which is its direction toward the outlet. Direction of groundwater flow is the determining factor in karstic development of calcareous aquifers and the lithological variations, faults and fissures are of secondary importance. A regional system of solution channels can be established only if the general hydrologic conditions remain practically constant during long time intervals. (Gabriel-USGS)
W69-09296

2K. Chemical Processes

CHEMISTRY OF THE SAN JOAQUIN RIVER SYSTEM UNDER BASE FLOW CONDITIONS,
Agricultural Research Service, Fresno, Calif. Ground Water Recharge Field Station.
Harry I. Nightingale, and Jerold J. Behnke.
J Amer Water Works Ass, Vol 61, No 8, p 382-386, Aug 1969. 5 p, 5 fig, 7 ref.

Descriptors: *Water quality, *Streamflow, *California, *Rivers, *Water chemistry, Solutes, Groundwater, Water analysis, Irrigation water, Reservoirs, Springs, Lakes, Precipitation (Atmospheric).
Identifiers: *San Joaquin River.

A water quality survey was made of the San Joaquin River, California, from its origin in the Sierra Nevada to its entry into the east side of the San Joaquin Valley. The base flow of the river system is considerably modified by dams, diversion tunnels, and pipelines for power projects, flood control, and irrigation, all of which alter water quality. From an irrigation standpoint, the quality of all the waters sampled within the San Joaquin River System (with the exception of West Chiquito Creek) was excellent. Although the salt content of the waters was quite low and all the waters were derived from essentially granitic terrain, marked chemical differences did exist between the source lakes and the river tributaries. Mammoth Pool contained more dissolved salts in somewhat different proportions than Huntington and Shaver Lakes. This difference is probably attributable to the fact that some of the higher drainage areas associated with Mammoth Pool contain volcanic and metavolcanic rocks and associated thermal springs, whereas the drainage basins for the 2 other lakes are composed almost exclusively of granitic material. The chemical differences observed in the tributary streams were generally attributed to differences in rock type in the drainage basin, groundwater return flow, or unusual spring discharges. There is approximately an increase in salinity of 6.2 in the water of the San Joaquin River System from its snow origin in the high Sierra Nevada to the eastern edge of the San Joaquin Valley. Most of the salinity increase takes place when the water infiltrates below the ground surface. The displacement of high quality lake waters by tunnels and pipes for hydroelectric power generation has probably improved the chemistry of the river by maintaining a firm base flow composed of high quality water stored in the Sierra Nevada lakes. (Knapp-USGS)
W69-09134

RAPID PHOSPHATE DETERMINATION BY FLUORIMETRY,
Missouri Univ., Columbia. Dept. of Chemistry; and Oak Ridge National Lab., Tenn. Div. of Analytical Chemistry.
For primary bibliographic entry see Field 05A.
W69-09137

ADSORPTION OF NONIONIC SURFACTANTS BY SOIL MATERIALS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 02G.
W69-09141

THE POTENTIOMETRIC ESTIMATION OF CHLOIDE IN WATER EXTRACTS OF SOILS,
Sydney Univ. (Australia). Dept. of Soil Science.
B. G. Davey, and Marion Joy Bembrick.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 385-387, May-June 1969. 3 p, 1 fig, 4 tab, 5 ref.

Descriptors: *Soil water, *Water chemistry, *Chlorides, *Water analysis, *Electrochemistry, Electrodes, Water quality, Laboratory tests, Instrumentation, Saline water.
Identifiers: Potentiometric analytical methods.

The thermodynamic equation for the e.m.f. developed between Ag-AgCl electrodes in a cell with liquid junction is derived for a complex electrolyte system containing Cl. The equation is tested experimentally and a method devised to determine Cl in water extracts of soil. The range of the method, 0.00005 M to 0.01 M Cl, is much more sensitive than either the electrometric, conductometric or the Volhard methods currently used in soil analysis. (Knapp-USGS)
W69-09145

METHODOLOGY OF HYDROCHEMICAL INVESTIGATIONS (RUSSIAN).
Akademiya Nauk SSSR, Leningrad. Gidrokhimicheskii Institut.

Gidrochim Mater, Vol 49, Gidrochim Inst, Leningrad, 1969. 246 p.

Descriptors: *Water chemistry, *Chemical analysis, *Reservoirs, Water balance, Sedimentation, Rain, Calcium, Carbonates, Trace elements, Radiochemical analysis, Strontium radioisotopes, Ice, Salt balance, Organic matter, Snowmelt, Soils.
Identifiers: *USSR, Hydrochemical studies of water reservoirs.

This volume presents the study of hydrochemical regimes of water reservoirs, mainly based on the study of the Otkaznenskiy reservoir located on the Kuma River, North Caucasus. Thirty articles in this volume discuss sedimentary and salt balances, hydrochemical characteristics, such as dissolved gases, organic matter, microelements, and stable and radioactive strontium and other hydrologic properties of water reservoirs. Numerous tables and figures are presented and 363 references are cited. (Gabriel-USGS)
W69-09152

GEO-CHEMICAL CLASSIFICATION OF GROUNDWATER IN THE CARMEL REGION,
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 07C.
W69-09157

A POSSIBLE THERMAL SPRING DEPOSIT IN THE 'ARAD AREA, ISRAEL,
Geological Survey of Israel, Jerusalem.
A. Issar, Y. Eckstein, and R. Bogoch.
Israel J Earth-Sci, Vol 18, No 1, p 17-20, 1969. 4 p, 7 fig, 2 tab, 2 ref.

Descriptors: *Thermal springs, *Chemical precipitation, Water chemistry, Mineralogy, Groundwater movement, Karst, Carbonate rocks.
Identifiers: Israel, 'Arad area.

A dolomite-chert breccia body, cemented by a hematite-goethite-barite-calcite mineral assemblage was found in the 'Arad area, Israel. This assemblage, plus the presence of anomalous quantities of various elements, particularly molybdenum, and the goethite-hematite relationship, suggest a thermal mineral spring deposit from a hypogene water source. (Knapp-USGS)
W69-09158

GROUND-WATER FLOW SYSTEMS AND THE ORIGIN OF EVAPORITE DEPOSITS,
Idaho Bureau of Mines and Geology, Moscow.
For primary bibliographic entry see Field 02F.
W69-09160

THE GEOCHEMISTRY OF MOLYBDENUM IN THE BLACK SEA,
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W69-09161

HYDROLOGICAL AND HYDROCHEMICAL CONDITIONS IN TIDAL POOLS ON THE EAST MURMAN COAST,
Leningrad State Univ. (USSR).
I. I. Zhyubikas.
Trans from Okeanologiya, Akad Nauk, SSSR. Oceanology, Vol 8, No 5, p 650-657, 1968. 8 p, 5 tab, 9 ref.

Descriptors: *Water chemistry, *Tidal waters, *Ponds, Salinity, Lagoons, Evaporation, Freezing, Phosphates, Nitrates, Water temperature, Dissolved oxygen, Nutrients.
Identifiers: *USSR, *Murman Coast, Tidal pools.

The hydrological and hydrochemical conditions in tide pools are considerably different from those in the inshore sea area. The greatest variations of hydrochemical conditions and differences from conditions in the sea are found in the supralittoral zone. In summer, the temperature in the pools exceeds that of the sea, but the salinity is lower especially in the surface layers, while the oxygen content is higher than in the sea. In some supralittoral pools the oxygen concentration may reach 300-400% saturation. However, at low tide at night it may fall to 13%. The concentration of phosphates and nitrates in some shallow littoral pools may be 20-30 times greater than in the sea, probably because of the action of mussels which inhabit the pools. In autumn hydrochemical differences between the pools and the sea are small and the pool temperature is below that of the sea, sometimes falling to 5 deg C or even 8 deg C. The salinity in the pools is higher than in the sea, and may reach 130-145 pp+ because of the precipitation of salt during ice formation. In spring the melting of the snow considerably reduces the salinity in the pools. Algal photosynthesis raises the amount of oxygen to 200-300% saturation. The concentration of nutrients decreases because of their consumption by algae. (Knapp-USGS)
W69-09179

DISTRIBUTION OF METHANE AND CARBON MONOXIDE BETWEEN THE ATMOSPHERE AND NATURAL WATERS,
Naval Research Lab., Washington, D.C.
J. W. Swinnerton, V. J. Linnenbom, and C. H. Cheek.
Environ Sci and Technol, Vol 3, No 9, p 836-838, Sept 1969. 3 p, 4 fig, 13 ref.

Descriptors: *Methane, *Seawater, *Atmosphere, *Estuaries, *Surveys, Water pollution effects, Path of pollutants, Water quality, Water chemistry, Equilibrium, Thermodynamic behavior, Mass transfer, Aqueous solutions.
Identifiers: *Carbon monoxide, Potomac River, Chesapeake Bay.

Methane and carbon monoxide concentrations in the atmosphere and in natural waters were measured during an oceanographic cruise between Washington, D.C. and Puerto Rico. The concentration of methane was highest in the upper Potomac River and decreased as the ocean was approached. Methane was at equilibrium between the atmosphere and the open ocean, where its average concentration in the atmosphere was 1.24 ppm. Conversely, carbon monoxide concentrations increased in the open ocean relative to the river and bay waters. Equilibrium was not observed for carbon monoxide, and the net transport of this gas appears to be from the water into the atmosphere for all samples analyzed. Atmospheric carbon monoxide concentrations ranged from 0.075 to 0.44 ppm. (Knapp-USGS)
W69-09230

OXYGENATION OF HYDROGEN SULFIDE IN SEAWATER AT CONSTANT SALINITY, TEMPERATURE, AND pH,
Washington Univ., Seattle. Dept. of Oceanography.
Joel D. Cline, and Francis A. Richards.
Environ Sci and Technol, Vol 3, No 9, p 838-843, Sept 1969. 6 p, 7 fig, 2 tab, 20 ref. Grant No GA-64 NSF.

Descriptors: *Oxidation, *Sulfides, *Seawater, *Water chemistry, Sulfates, Sulfur, Sulfur compounds, Biodegradation, Sulfur bacteria, Chemical reactions, Laboratory tests, Hydrogen sulfide.
Identifiers: *Sulfites.

The kinetics of the reaction between sulfides and oxygen in seawater (S= 30.27%) at 9.8 deg C are described. The rate of change of concentrations of total sulfide, oxygen, thiosulfate, sulfite, and pH were determined. Total sulfide, thiosulfate, and sulfite were determined colorimetrically, oxygen chromatographically, and pH electrometrically. The reaction is complex, as indicated by the variety of products, but the temporal course of the reaction generally follows mixed second-order kinetics after the first few hours of the reaction. The apparent rate constants for oxygen and total sulfide were .0015 in the concentration ranges investigated. The major reaction products were thiosulfate and sulfate, with sulfite occurring as an unstable but fairly long-lived intermediate product. The reaction rate decreases as the solid surface area increases. (Knapp-USGS)
W69-09231

DETERMINATION OF PHOSPHATE IN NATURAL WATERS BY ACTIVATION ANALYSIS OF TUNGSTOPHOSPHORIC ACID,
Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Lab.; and Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
Herbert E. Allen, and Richard B. Hahn.
Environ Sci and Technol, Vol 3, No 9, p 844-848, Sept 1969. 5 p, 5 fig, 2 tab, 8 ref.

Descriptors: *Analytical techniques, *Water analysis, Neutron activation analysis, *Trace elements, *Water chemistry, Chemical reactions, Phosphates.
Identifiers: *Tungsten analysis.

Activation analysis may be used to determine quantitatively traces of phosphate in natural waters. Methods are subject to interference by sulfur and chlorine. If the ratio of phosphorus to sulfur or chlorine is small, as it is in most natural waters, accurate analyses by these methods are difficult to achieve. In the activation analysis method, molybdate and tungsate ions are added to samples containing phosphate ion to form tungstomolybdophosphoric acid. The complex is extracted with 2,6-dimethyl-4-heptanone. After activation of an aliquot of the organic phase the gamma spectrum is essentially that of tungsten-187. The induced activity is proportional to the concentration of phosphate in the sample. A test of the method showed it to give accurate results at concentrations of 4 to at least 200 ppb of phosphorus when an aliquot of 100 microliters was activated. By suitable reagent purification, counting for longer times, and activation of larger aliquots, the detection limit could be lowered several hundredfold. (Knapp-USGS)
W69-09232

THE EFFECT OF CATION EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 1. ADSORPTION AND RELEASE,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 05B.
W69-09249

THE CONCENTRATIONS OF LITHIUM, POTASSIUM, RUBIDIUM AND CESIUM IN SOME WESTERN AMERICAN RIVERS AND MARINE SEDIMENTS,
Scripps Institution of Oceanography, La Jolla, Calif.
C. Sreekumaran, K. C. Pillai, and T. R. Folsom.
Geochim et Cosmochim Acta, Vol 32, No 11, p 1229-1234, Nov 1968. 6 p, 5 tab, 11 ref.

Descriptors: *Water chemistry, *Potassium, *Cesium, *Trace elements, *Rivers, Marine geology, Sediments, Ocean circulation, Water circulation, Water analysis, Sampling, Suspended load, Photometry, Streamflow.
Identifiers: Rare elements in river water, Marine sediments.

Lithium, potassium, rubidium and cesium contents in river water, suspended loads, and bottom sediments were measured by a flame photometric method in samples from three Western American river systems and from marine sediments. Alkali metals in freshwater, alkali metals in river sediments and suspended matter, natural cosium transported by rivers, lithium potassium, rubidium, and cesium found in four marine sediments, and comparative residence of the alkali metals in the ocean are tabulated. (Gabriel-USGS)
W69-09281

ON BICARBONATE DETERMINATION IN NATURAL WATER (ROMANIAN),
Dumitru Ceausescu.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 3, p 147-149, Mar 1968. 3 p, 1 tab, 12 ref.

Descriptors: *Bicarbonates, *Analytical techniques, *Water chemistry, Acidity, Alkalinity, Indicators, Anion exchange, Cation exchange, Water properties, Acids.
Identifiers: Bicarbonate measurement.

The three most commonly used methods for determination of bicarbonates in water are discussed. These methods are: (1) Titration with a strong acid in the presence of an indicator. However, the carbonates and other hydroxyls are also measured at high pH values; (2) calculation of carbonates from total carbonic acid and pH; Measurement of pH should be very accurate, since only small errors in pH measurement will be appreciably increased in the amount of bicarbonates; and (3) measurement of all cations and all anions except bi carbonates. The difference between cations and anions thus calculated is considered to represent the amount of bicarbonates. The humates are included in bicarbonates by using the last method. A new method is proposed by the author which is simple, rapid, direct and free of interferences. The total content of weak anions is determined by titration with a strong acid in a carbon dioxide-free atmosphere

and in the presence of a mixed indicator. This operation is then followed by a back titration with a strong base to the initial pH of water. The difference between the two titrations represents the amount of bicarbonates. At pH 7 -8.4, the carbonates are also included in this value. (Carstea-USGS)
W69-09289

PROBLEMS OF THE CHEMISTRY OF NATURAL WATERS OF THE SOVIET UNION AND METHODS SUITABLE FOR THEIR ANALYSIS (RUSSIAN).
Akademiya Nauk SSSR, Leningrad. Gidrokhimicheskii Institut.

Stradomskiy, V. B., Editor. Gidrokhimicheskiye Mater, Tom 48, 1968. 180 p, 46 fig, 65 tab, 374 ref.

Descriptors: *Methodology, *Water analysis, *Water chemistry, Water quality, Runoff, River basins, Biochemistry, Ion transport, Reservoirs, Copper, Manganese, Aquifers, Organic matter, Clay minerals, Sludge disposal, Ultraviolet radiation, Suspended load, Potassium, Lakes.
Identifiers: *USSR, Chemistry of Natural waters, Strontium.

A collection of 24 articles by USSR scientists discusses the formation of chemical compounds, the regime of the most common ions, trace elements, biogenetic elements, and organic matter present in the water of lakes, rivers, and reservoirs of the USSR. Several articles are devoted to the methods for the determination of organic content in the natural waters and to the problems of self-purification of natural waters from their organic and inorganic pollution. Russian abstracts of the individual articles are included. (Gabriel-USGS)
W69-09291

TUFF-DEPOSITING WATER TYPES AND CORROSION INTENSITY IN THE NORTHWESTERN PART OF THE DINARIC KARST,
Ivan Gams.
Hydrol of Fractured Rocks Vol 2, Proc Dubrovnik Symp (Oct 1965), Int Ass Sci Hydrol, Pub 74, p 684-689, 1967. 6 p, 4 tab.

Descriptors: *Geochemistry, *Spring waters, *Chemical analysis, Springs, Rivers, Karst, Calcium compounds, Magnesium, Sulfates, Hardness (Water), Lakes, Limestones, Temperature, Silica, Precipitation, Runoff.
Identifiers: *Yugoslavia, Hydrochemical measurments, Tufa deposits.

Water composition and the character of depositions in rivers and springs of the northwestern Dinaric Karst were investigated by recording temperatures, CaO, MgO, and sulfate contents, mean precipitation, runoff, and the volume of rocks in solution. River tuff deposits occur where the tributaries are carrying water rich in MgO or sulfite. Karstic springs in Slavonia rich in CaO or CaO+ MgO and other minerals, are characterized by their tuff deposits. The highest corrosion intensity occurs in the carbonaceous sediments characterized by high runoff and covered with soil. Geological composition, vegetation, soil, precipitation and land use have a strong effect on the degree of corrosion intensity. (Gabriel-USGS)
W69-09299

CHEMICAL DECOMPOSITION OF NITRITE IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
J. M. Bremner, and D. W. Nelson.
Transactions 9th Int Congress of Soil Science, Vol II, Paper 52, p 495-503, 1968. 4 tab, 21 ref.

Descriptors: *Chemical degradation, *Nitrites, *Soil chemistry, Nitrogen, Nitrogen compounds, Nitrogen cycle, Cycling nutrients, Water pollution sources, Soils.
Identifiers: Nitrogen balance, Nitrogen losses (Soils), Nitrite decomposition.

Recent investigations at Iowa State University of the factors affecting chemical decomposition of nitrite in soils and mechanisms of nitrite decomposition are reviewed by the authors. Nitrite decomposition in soils is controlled largely by soil pH and organic matter content, and is due to reaction of nitrite with soil organic matter and to self-decomposition of nitrous acid. Treatment of neutral and acidic soils with nitrite leads to fixation of nitrite-nitrogen and to volatilization of nitrite-nitrogen as nitrogen, nitrogen dioxide, and nitrous oxide. Nitrite-nitrogen lost by nitrite decomposition can be recovered quantitatively as (nitrate plus fixed plus nitrogen plus nitrogen dioxide plus nitrous oxide) minus nitrogen. Phenolic substances in soil organic matter react readily with nitrite under soil conditions to form nitroso-phenols that are decomposed by nitrous acid with formation of nitrogen and nitrogen dioxide. (Keeney-Wis)
W69-09337

CONTROL OF MIXED-SUBSTRATE UTILIZATION IN CONTINUOUS CULTURES OF ESCHERICHIA COLI,
Massachuset ts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
Richard S. Silver, and Richard I. Mateles.
J Bacteriology, Vol 97, No 2, p 535-543, Feb 1969. 6 fig, 2 tab, 40 ref.

Descriptors: *Bacteria, Enzymes, Growth chambers, Organi c compounds, Genetics, Growth rates.
Identifiers: *Escherichia coli, *Chemostat, *Substrate utilization, Escherichia coli B6, beta-galactosidase, Aspartase, Steady-state growth, Glucose, Lactose, L-aspartic acid, Constitutive mutant, Continuous culture.

Authors deal with mechanisms controlling rate of utilization of glucose and lactose by Escherichia coli B6, but the technique could be applied to testing preferential use of any simple mixture of metabolites by pure cultures. By the chemostat principle of continuous growth at steady state (level controllable), the growth rate is set at any level by rate of supply of nutrients. Analyses for growth rate, ratio of metabolites in the washout, and specific enzyme levels and their activity, indicate the control mechanisms of the differential utilization. In the case studied, constitutive mutants for beta-galactosidase emerged; glucose and lactose were both utilized at low growth rates but only glucose at high growth rates. Catabolic repression was the primary mechanism of beta-galactosidase level and thus of lactose utilization. With L-aspartic acid, direct anabolic utilization for protein synthesis and catabolic incorporation occurring simultaneously, allowed uti lization at even low levels of the catabolic enzyme concerned. Mixed populations of microorganisms and of complex mixed metabolites would not allow analyses of specific catabolite repression, but the chemostat principle of controlled steady-state growth might be useful in studies with aquatic bacteria. (McCoy-Wis)
W69-09341

FLOWS AND CYCLES OF MACRO- AND MICRO-ELEMENTS IN A FOREST SOIL AND ITS ENVIRONMENT,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand).
R. B. Miller.
9th Int Congress of Soil Science Transactions, Vol IV, Paper 34, p 323-331, 1968. 3 tab, 5 ref.

Descriptors: Ecosystems, Rainfall, Drainage, Elements (Chemical), Soil properties, Forest soils, Calcium, Phosphorus, Silicon, Manganese.
Identifiers: Soil inputs, Soil outputs, Hutt Valley, New Zealand, Akatarawa hill soil, Soil elements, Macro-elements, Micro-elements, Element cycles, Wellington.

Data on the movements of 19 macro- and micro-elements in an ecosystem with hard beech (Nothofagus t runcata) growing on a strongly leached acid brown forest soil near Wellington, New Zealand, are presented. Balance sheets which show the i nputs (leaf-wash, rainwater, cycled, dry salt and litter) and outputs (uptake, stored, cycled and leached) are given. Drainage accounted for the following outputs (kilogram/hectare/year): Calcium, 26; magnesium, 22; potassium, 6; sodium, 76; phosphorus, 0.2; nitrogen, 2.4; sulfur, 8; chlorene, 134; silicon, 49; aluminum, 1.0; barium, 0.025; chromium, 0.001; copper, 0.05; iron, 0.35; manganese, 0.001; molybdenum, 0.0015; nickel, 0.005; strontium, 0.32; titanium, 0.015. Calcium was typical of many of the elements, the amounts from the atmosphere being sufficient to cover the amount immobilized in the growing trees, and a high proportion of the pool in the rooting zone being required for the annual cycle. A large amount of silica was cycled in the trees (200 kilograms/hectare/year) and a large amount released to the drainage system (100 kilograms/hectare/year). (Keeney-Wis)
W69-09343

MASS SPECTROMETRIC MEASUREMENT OF NITROGEN-15 ENRICHMENT IN NITROGEN OBTAINED BY DUMAS COMBUSTION,
National Research Council of Canada, Halifax (Nova Scotia). Atlantic Regional Lab.
D. Desaty, R. McGrath, and L. C. Vining.
Analytical Biochemistry, Vol 29, No 1, p 22-30, Apr 1969. 4 tab, 9 ref.

Descriptors: *Chemical analysis, *Nitrogen.
Identifiers: *Mass spectrometry, *Nitrogen-15, *Nitrogen enrichment, *Dumas procedure, Nitrogen analyzer.

The authors describe a rapid, accurate, Dumas method for determining nitrogen-15 enrichments from 0.37 to 100%. Compounds with only one nitrogen atom exhibit random pairing, but equilibration is incomplete in compounds with two or more variously bonded (nitrogen-nitrogen, oxygen-nitrogen, and carbon-nitrogen) nitrogen atoms. Failure to equilibrate is presumed to result from differences in bond energy between nitrogen and adjacent atoms. Modifications of the Coleman Model 29 nitrogen analyzer for use in collecting samples for nitrogen-15 measurement are described. (Keeney-Wis)
W69-09344

STEADY STATE STUDIES OF NITRIFICATION IN SOIL: THEORETICAL CONSIDERATIONS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
A. Douglas McLaren.
Soil Science Socity of Amer Proc, Vol 33, No 2, p 273-276, Mar-Apr 1969. 1 fig, 17 ref.

Descriptors: *Equilibrium, *Nitrification, *Soil chemistry, *Theoretical analysis, Nitrogen cycle, Nitrates, Nitrites, Ammonium.
Identifiers: Miscible displacement, Clynamics.

The author states that since, in nature, ammonia produced by microbial action or added as fertilizer is subjected to downward translocation, therefore, continuous flow laboratory columns would be more nearly representative of field conditions than reperfusion methods. Equations are set up for consecutive reactions in an idealized soil column and solved for concentrations of metabolites as functions of time and depth within the column under steady state conditions. The reactions of ammonium ion to nitrite ion to nitrate ion were so expressed for columns with maximum numbers of nitrifying organisms. (Keeney-Wis)
W69-09345

DETERMINATION OF SOIL CATION EXCHANGE CAPACITY BY A SIMPLE SEMIMICRO TECHNIQUE,
Wisconsin Univ., Madison. Dept. of Soils.

D. R. Keeney, and J. M. Bremner.
Soil Science, Vol 107, No 5, p 334-336, 1969. 1 tab, 11 ref.

Descriptors: *Soil chemistry, *Cation exchange, *Chemical analysis, Ammonium compounds.
Identifiers: *Cation exchange capacity, Ammonium retention, Ammonium fixation.

The authors describe a cation exchange capacity (CEC) method which does not involve removal of the excess saturating cation by exhaustive washing procedures, thus eliminating sources of error in this determination due to salt retention, loss of the index cation by hydrolysis, or sample dispersion. In this method, the soil sample is treated with ammonium acetate (1 Normal, pH 7), the ammonium acetate removed by leaching with an ammonium-nitrate solution, and the treated sample analyzed directly for ammonium-nitrogen by steam distillation with sodium chloride (2 Moles) and magnesium oxide after partial removal of ammonium nitrate by washing with a small amount of isopropanol. The amount of nitrate-nitrogen in the sample is subsequently determined by steam distillation of the sample with Devarda alloy, and the amount of salt retained in the sample corrected by use of the nitrate-nitrogen value. The method is simple and precise, is not subject to obvious errors of many other CEC procedures, and gives results similar to accepted CEC methods involving use of ammonium as the index cation. (Keeney-Wis)
W69-09346

RADIATION AS A TECHNIQUE IN SOIL BIOLOGY AND BIOCHEMISTRY,
California Univ., Davis. Coll. of Agriculture.
A. D. McLaren.
Soil Biology and Biochemistry, Vol 1, No 1, p 63-73, 1969. 1 tab, 59 ref.

Descriptors: *Soil chemistry, *Irradiation, Soils, Microbiology, Nutrients.
Identifiers: *Soil biology, *Soil biochemistry, Sterilization.

A review of the utilization of ionizing radiation in soil is presented. Included are observations on the differences in sensi tivities of various genera of soil microorganisms to radiation sterilization and on residual enzyme activities in sterile soil. As a rule, the larger the microbe the smaller is the minimum dose required. Generally, microorganisms and enzymes are killed or inactivated as exponential functions of dose of radiation, but the dose requirements depend upon the soil t ype, soil moisture and genus of organism. Irradiation induces release of small amounts of manganese, ammonium, soluble carbon, organic nitrogen, phosphorus, etc. from soil microbes and, to a lesser extent, from humus. The nutrients released can stimulate plant growth in radiation sterilized soil; no toxicity has been noted following soil irradiation. Cells no longer able to proliferate after irradiation may still be biochemically active, e.g. in respiration and nitrification. Irradiated soil is useful for studies of plant-soil-microbe relationships in cases where residues from chemical sterilizing reagents of toxic products from steam sterilization treatment are to be avoided. (Keeney-Wis)
W69-09350

RESPONSE OF CHEMOAUTOTROPHIC NITRIFIERS TO FOREST CUTTING,
Yale Univ., New Haven, Conn.; and Dartmouth Coll., Hanover, N.H.
W. H. Smith, F. H. Bormann, and G. E. Likens.
Soil Science, Vol 106, No 6, p 471-473, 1968. 1 tab, 10 ref.

Descriptors: *Nitrogen cycle, *Nitrification, *Forest management, Ecosystems, Leaching, Runoff, New Hampshire, Watersheds (Basins), Soil bacteria.
Identifiers: *Chemoautotrophs, *Forest cutting, Nitrosomonas, Nitrobacter, Hubbard Brook Experimental Forest, New Hampshire, Nutrient removal.

Soils from cutover and undisturbed forest ecosystems in the Hubbard Brook Experimental Forest, New Hampshire, were analyzed for populations of the Nitrosomonas and Nitrobacter groups by the most probably number method. Although the soils in both watersheds were extremely acid (pH 4), they had relatively large populations of Nitrosomonas (9,700-1,850,000 cells/gram). The cutover watershed contained significantly higher numbers of both groups of nitrifiers than did the control watershed. Previous investigations in 1966 had shown that the cutover watershed had a large net release of nitrogen (57 kilograms/hectare) while the control had a net gain of 4.5 kilograms/hectare. The authors felt that the initial increase in chemautotrophic activity was closely related to factors, other than the microclimate, directly correlated with the removal of vegetation. (Keeney-Wis)
W69-09351

2L. Estuaries

A NUMERICAL MODEL OF THE SALINITY DISTRIBUTION IN UPPER CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
William Boicourt.
Chesapeake Bay Inst Tech Rep No 54, May 1969. 59 p, 18 fig, 28 ref, 3 append. ONR Contract No Nonr 4010 (11). Project No NR083-016.

Descriptors: *Estuaries, *Mathematical models, *Salinity, *Flow, Mixing, Diffusion, Turbulence, Water circulation, Currents (Water), Tides, Computer programs, Input-outputanalysis.
Identifiers: *Chesapeake Bay, Susquehanna River.

Upper Chesapeake Bay can be modeled as a one-dimensional estuary to predict the salinity distribution for a given fresh water inflow from the Susquehanna River. The one-dimensionality implies that salinity values are averages taken over the cross section of the estuary and that variables are related only to time and position along a longitudinal axis. The model presented in this study is based on a salt continuity equation in which the seaward salt advection is balanced by turbulent diffusion toward the head of the Bay. Since the interest is in the effects of net non-tidal circulation, the governing equation has been averaged over the tidal cycle. In final form, it is a linear, parabolic partial differential equation with variable coefficients. One years's salinity data were used to determine the functional dependence of the coefficients on the fresh water inflow. The boundary value at the head of the estuary is held fixed, while the seaward boundary value is allowed to vary with time. A separate predictor model relates this value to the flow of the Susquehanna. The computer program listing is included. (Knapp-USGS)
W69-09146

APPRAISAL OF RESEARCH ON DESERT COASTAL ZONES,
Arizona Univ., Tucson; and Army Natick Labs., Mass.
Joseph F. Schreiber, Jr.
IN W.G. McGinnies, B.J. Goldman, and Patricia Paylore, eds., Deserts of the World, an Appraisal of Research into their Physical and Biological Environments, p 647-724, University of Arizona Press, Tucson, 1968. 78 p, 1 fig, 2 tab, 530 ref.

Descriptors: *Deserts, *Coasts, *Synoptic analysis, Arid lands, Arid climates, Semiarid climates, Beach erosion, Beaches, Deltas, Dunes, Geomorphology, Sands, Shore protection, Shoreline cover, Wind erosion, Bibliographies, Coastal marshes, Ocean currents, Swamps, Coastal engineering, Harbors, Intertidal area, Littoral, Surf, Tides, Estuarine environment, Marine geology, Ocean currents, Ocean waves, Oceanography, Gulf.
Identifiers: Australian coastal deserts, Mexican coastal deserts, Peruvian coastal deserts, Chilean coastal deserts, Saudi Arabia, Patagonian coastal deserts, African coastal deserts, Arabian Sea, Persian Gulf, Red Sea.

This study is an inventory and evaluation of literature and research regarding those areas of the Earth where major deserts meet the sea. The following factors are included: nearshore bottom conditions; tides and currents; surf, breakers, and waves; beaches; shore and nearshore erosion and sedimentation; coastal swamps and marshes; and coastal structures and other culture features. An introduction, survey of information available, and review of current research and suggested research is presented for each of the 14 coastal deserts treated. The most important authorities, libraries, data centers and sources of published information are discussed. The evaluation includes discussion of outstanding contributions, significant theories and contributions, nature of the most useful study, model studies and deficiencies in knowledge. It is recommended that an organized, systematic, well-supported research program is essential to achieve the objective of a basic understanding of the physical, biological, and cultural factors, individually and collectively, that combine to give the coastal desert zone its distinctive characteristics. Specific research areas for future work are detailed. (See W69-09206). (Sherbrooke-Ariz)
W69-09209

EXTRAORDINARY TIDAL CURRENTS NEAR ST. KILDA,
National Inst. of Oceanography, Wormley (England).
D. E. Cartwright.
Nature, Vol 223, No 5209, p 928-930, Aug 30, 1969. 3 p, 3 fig, 2 tab.

Descriptors: *Currents (Water), *Tides, Tidal effects, Diurnal, Ocean currents, Continental shelf, Water level fluctuations.
Identifiers: United Kingdom, Hebrides, St. Kilda.

Recent current and water level measurements in the Hebrides, UK show that although the vertical tide at St. Kilda has a normal diurnal inequality, the diurnal tidal currents are unusually strong. The spectral analysis evidence points to a nondivergent tidally induced continental shelf wave. (Knapp-USGS)
W69-09233

RADIOACTIVE METHODS FOR THE QUANTITATIVE DETERMINATION OF COASTAL DRIFT RATE,
Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
For primary bibliographic entry see Field 07B.
W69-09247

A NOTE ON THE EFFECT OF DISPERSION ON MEAN CURRENT MEASUREMENTS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Akira Okubo.
Chesapeake Bay Inst Tech Rep No 55, June 1969. 14 p, 6 fig, 9 ref, append. AT (30-1) 3109 AEC NYO-3109-44 ONR.

Descriptors: *Estuaries, *Currents (Water), *Current meters, *Statistical methods, *Tracers, Tracking techniques, Dye releases, Diffusion, Turbulence.
Identifiers: Current measuring errors.

The difficulty with drift type current measuring devices is that they move in a random way with respect to the mean current. Thus, when a small number of current followers are used, the values of mean current derived from the observations do not necessarily represent the true values which could be approximated more clearly by a large number of drift devices. In light of the present knowledge of oceanic diffusion, statistical errors associated with current measurement of this type may be estimated. These errors are generally of the order of 1 cm/sec, but may, in some cases, be as large as 10 cm/sec. The statistical problem can be solved partially by the use of tracers; dye tracers have proved to be quite useful in measuring the mean current as

well as in studying diffusion. One must, however, be careful not to interpret the movement of dye patches simply as indicative of the mean current. A knowledge of turbulent diffusion is also needed. (Knapp-USGS)
W69-09252

MAXIMUM ENTROPY MIXING IN ESTUARIES,
Manhattan Coll., Bronx, N.Y.
Dominic M. DiToro.
J Hydraul Div ASCE, Vol 95, No HY4, p 1247-1271, July 1969. 25 p, 8 tab, 37 ref.

Descriptors: *Estuarine environment, *Markov processes, *Entropy, *Salinity, Optimization, Mathematical models, Delaware River, Mixing, Tidal waters, Numerical analysis.

The application of different mathematical models and estuarine theories of maximum entropy mixing for optimum estuarine environment were reviewed. The theory of tidal mixing proposed by Predy formed the basis for the model of maximum entropy mixing which was developed in terms of Markov chains. Three conservation laws which any physically reasonable mixing process must satisfy were related to the properties of a Markov chain. The estimate of the appropriate mixing matrix was based on maximum entropy of statistical mechanics and information theory. A numerical technique was employed for solving the resulting simultaneous transcendental equations. A comparison of the equilibrium salinity intrusion data from the Delaware River Model and the theoretical predictions based on the maximum entropy estimate of the mixing process indicated that the theory of entropy mixing is a sound and practical solution to the problem of characterizing the mixing process in an estuary. (Thiuri-Cornell)
W69-09357

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

FRESHWATER AND METHODS FOR ITS PRODUCTION FROM SEAWATER,
Leningrad Higher School of Marine Engineering (USSR).
V. I. Vul'fson.
Oceanology, Vol 7, No 1, p 1-10, 1967. 10 p, 8 fig, 2 tab, 21 ref. Trans by Amer Geophysical Union from Okeanologiya, Akad Nauk, SSSR, Vol 7, No 2.

Descriptors: *Desalination processes, *Water resources development, Saline water, Freshwater, Seawater, Semipermeable membranes, Solvent extractions, Freeze drying, Resins, Dialysis, Ion exchange, Reverse osmosis, Evaporation.
Identifiers: *USSR, *Methods for water desalination.

The freshwater is unevenly distributed on the earth's surface. Moreover, the geographical distribution of freshwater does not coincide with the present water requirements. The water supply can be improved by redistribution of water resources by more rational utilization and re-use of water and by desalinization of seawater. In the Soviet Union, the water desalinization is very important for the areas of Azerbaijan, Turkmenia, and Kazakstan. The production of freshwater from seawater at a low cost is the most important problem facing the water managers. This paper briefly discusses the advantages and disadvantages of the common desalinization methods. These methods are: Evaporation, freezing, electric ion-exchange, ion-exchange, reverse osmosis, extraction, use of ion-active resins, destruction of the aqueous solution structure, and biological method. The evaporation method is the most widely used for desalinization purposes. All methods used require energy and, therefore, cheap sources of energy is of utmost importance to maintain the cost of the desalinization process as low as possible. The use of atomic power seems to be the best future source of energy for desalinization. (Carstea-USGS)
W69-09203

FUTURE USE OF DESERT SEACOASTS,
Peveril Meigs.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 101-118, University of Arizona Press, Tucson, 1969. 18 p, 8 fig, 35 ref.

Descriptors: *Forecasting, *Deserts, *Coasts, *Water utilization, Future planning (Projected), Economic prediction, Cloud seeding, Fog, Desalination, Desalination plants, Agriculture, Competting uses, Domestic water, Recreation demand, Groundwater, Arid zones, A rid climates, Hydroponics, Trenches, Water conservation, Water consumption, Water reuse, Cisterns.

The forecast for the next 10 or 20 yr. is that there will be no natural permanent change in rainfall, river flow, or groundwater level, and that men will not by artificial means increase rainfall in desert seacoasts. Desalinated seawater will be used more and more for domestic water supplies and for manufacturing, but not for field farming. Various types of desalination are reviewed as are studies on condensation of fog. Cities and towns will continue to grow more than rural areas; suburbs, dairying, and truck farming will increase just outside the cities. Recreation and retirement facilities will grow, within the sphere of cities and far from cities. Agriculture will grow sporadically in places where men develop groundwater and river water previously unused, and locally, surface water. Hydroponics will be increasingly used where water is expensive. Improved utilization of water resources for agriculture will include groundwater pumping, trench farming, crops with lower water use, water reuse, and deep cisterns. Growth of mining, sea industries, recreation, science and conservation are also expected in desert seacoasts. (See W69-09210). (Sherbrooke-Ariz)
W69-09211

A DESERT SEACOAST PROJECT AND ITS FUTURE,
Arizona Univ., Tucson. Environmental Research Lab.
Carl H. Hodges.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 119-126, University of Arizona Press, Tucson, 1969. 8 p, 4 fig, 5 ref.

Descriptors: *Desalination plants, *Coasts, Deserts, Arid zones, By-products, Desalination apparatus, Desalination processes, Condensers, Pilot plants, Greenhouses, Water utilization efficiency, Crop production, Transpiration, Powerplants.
Identifiers: *Water-power-food complex.

This paper reports on a joint project of the University of Sonora and the University of Arizona to develop an integrated facility for the production of power, water and food for coastal desert areas. A pilot plant was constructed at Puerto Penasco, Mexico. Plans for a solar distribution plant were changed when it was found that almost all coastal communities have waste thermal energy from power plants. The pilot plant utilizes waste thermal energy from the diesel-electric plant that generates the power for the experimental complex. The desalination plant is a 6,000 q./day humidification type distillation unit. 160 deg F seawater is supplied by the power plant, while 78 deg F seawater is taken from a saltwater well. Food production is accomplised in inflated plastic greenhouses, which maintain 100 per cent relative humidity. These units are kept cool by circulation of the air through a seawater spray. During winter months there is a net production of freshwater in the greenhouses due to condensation. Larger units, 64,000 q./day, are presently under evaluation and it is expected that units of this size will be utilized in some areas of the world within the next few years. (See W69-09210). (Sherbrooke-Ariz)
W69-09212

IMPORT ALTERNATIVES,
Oak Ridge National Lab., Tenn.
Gale Young.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 382-397, University of Arizona Press, Tucson, 1969. 16 p, 14 fig, 53 ref.

Descriptors: *Water utilization, *Water conservation, Arid lands, Water transfers, Hydrologic cycle, River flow, Acreage, Cultivated lands, Agriculture, Waste water treatment, Sewage disposal, Waste water (Pollution), Sewage treatment, Water reuse, Waste water reclamation, Cost analysis, Cost comparisons, Membrane processes, Desalination processes, Evaporators, Water utilization, Runoff, Watershed management, Vegetation, Fog, Cloud seeding.
Identifiers: Granges Valley.

This paper reviews some water management alternatives to large-scale transfers of water. Data on the world water cycle and on average river flows of some of the important rivers of the world are presented. Arid areas are treated in historical perspective, and their land area is compared to that of agricultural areas. The water development potential of the Ganges Valley is pointed out. Utilization of rivers to carry garbage and waste to the sea is related to water pollution and water shortage problems. Diagrams, formuli and water costs for large city water systems with recycling of water are presented. Several types of desalination are discussed and costs are computed for these and various combined treatment-desalination systems for large cities. Problems of efficient use of desalinated water in seashore agriculture are considered. Methods are discussed of increasing precipitation by seeding clouds and 'catching' fog, and of increasing runoff by alteration of the vegetation. (See W69-09210). (Sherbrooke-Ariz)
W69-09220

AN ECONOMIC AND ENGINEERING ANALYSIS OF THE ELECTRODIALYSIS PROCESS,
Bechtel Corp., San Francisco, Calif.
J. Winston Porter, and S. Cherney.
OSW R and D Report No 470, 1969. 142 p. OSW 14-01-0001-1704.

Descriptors: *Desalination, *Electrodialysis, *Membrane Processes Cost Optimization, Plant Design.
Identifiers: *Desalination Apparatus, *Electrochemistry, Computer algorithm, Economics.

A parametric engineering and economic analysis of the electrodialysis process was performed in which water costs were examined for demineralizing three reference brackish waters in plant sizes of 1, 10 and 50 mgd capacity. Capital costs and operating parameters were first based on detailed plant designs using state-of-the-art technology, and computerized process and plant design calculations provided specifications for producing lowest-cost water in each case. Additional plant designs and cost estimates were developed to evaluate the effect of projected technological developments on demineralized water costs. (Mintz - Office of Saline Water).
W69-09226

DISPOSAL OF BRINE EFFLUENTS FROM INLAND DESALTING PLANTS: REVIEW AND BIBLIOGRAPHY,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 05E.
W69-09353

SPRAY SYSTEMS - A METHOD OF INCREASING WATER EVAPORATION RATES TO

FACILITATE BRINE DISPOSAL FROM DESALTING PLANTS,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 05E.
W69-09354

3B. Water Yield Improvement

DESERTS OF THE WORLD, AN APPRAISAL OF RESEARCH INTO THEIR PHYSICAL AND BIOLOGICAL ENVIRONMENTS.
Arizona Univ., Tucson. Inst. of Arid Lands Research.

The University of Arizona Press, Tucson, 1968. 788 p. Editors: William G. McGinnies, Brian J. Goldman, and Patricia Paylore.

Descriptors: *Arid lands, *Deserts, *Environment, Environmental effects, *Arid climates, Semiarid climates, Tropical regions, *Reviews, Synoptic analysis, *Bibliographies.

International in its scope and treatment, this volume presents for the first time a comprehensive, evaluative inventory of the state of current knowledge and research dealing with the world's desert environments. Included in the composite study are works by recognized authorities in seven topical fields covering physical features, vegetation, animal life, weather and climate, coastal zones, and groundwater research. Based upon a critical review of available scientific literature, individual contributors set out to ascertain notable deficiencies, and review and evaluate existing information within the scope of their respective fields. The comprehensive collection and integration of material is a contribution of major proportions to the general cognizance of dry-land studies. The authors have illuminated the need for future acceleration in synthesis and arid-land research. A United States contribution to the International Hydrological Decade. (See also W69-09207 thru W 69-09209).
W69-09206

APPRAISAL OF RESEARCH ON WEATHER AND CLIMATE OF DESERT ENVIRONMENTS,
Arizona Univ., Tucson; and Army Natick L abs., Mass.
For primary bibliographic entry see Field 02B.
W69-09207

APPRAISAL OF RESEARCH ON SURFACE MATERIALS OF DESERT ENVIRONMENTS,
Arizona Univ., Tucson; and Army Natick Labs., Mass.
For primary bibliographic entry see Field 02G.
W69-09208

APPRAISAL OF RESEARCH ON DESERT COASTAL ZONES,
Arizona Univ., Tucson; and Army Natick Labs., Mass.
For primary bibliographic entry see Field 02L.
W69-09209

ARID LANDS IN PERSPECTIVE, (Including AAAS Papers on Water Importation Into Arid Lands).
American Association for the Advancement of Science, Washington, D.C.

The University of Arizona Press, Tucson, Arizona, 1969. 421 p. William G. McGinnies, and Bram J. Goldman, Editors.

Descriptors: *Arid lands, *Deserts, Arid climates, Semiarid climates, *Water utilization, *Water transfer, *Reviews, Bibliographies.

This book was compiled under the leadership of the Advisory Committee for Arid Lands Research of the University of Arizona and the Committee on Arid Lands of the American Association for the Advancement of Science. The 31 articles in this publication represent the combined efforts of many people with varied orientations to summarize aspects of current research and knowledge relevant for the multitudes attempting to inhabit Earth's warm arid areas, noted for their imbalance of natural resources, one of the most important of which is water. (See also W69-09211 thru W69-09225).
W69-09210

LARGE-SCALE TRANSFERS OF WATER AND ALTERNATIVES,
Arizona Univ., Tucson. Water Resources Center.
Sol Resnick.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 418-421, University of Arizona Press, Tucson, 1969. 4 p.

Descriptors: *Arizona, *Water conservation, Arid lands, Deserts, Desalination, Water transfers, Interbasin transfer, Import, Reservoir evaporation, Evaporation control, Alcohols, Artificial recharge, Waste water disposal, Water reuse, Surface runoff, Water harvesting, Small watersheds, Sodium chloride, Sewage treatment, Electric power plants, Irrigation-efficiency, Economic feasibility.
Identifiers: Styrofoam.

The author reports on water related research programs at the University of Arizona that pertain to the development of alternatives to large-scale water imports. Evaporation suppression studies concluded that use of long-chain fatty alcohols on less than one-acre ponds was not economically feasible. Use of floating styrofoam rafts was much more encouraging, $65 per acre-foot of water saved (approx. equal costs of large scale water transfers). Experimental use of Tucson Gas and Electric Company's effluent for artificial groundwater recharge is reported on. Two approaches toward increasing the runoff from desert watersheds are being studied. One involves rather limited catchments to provide stock or municipal supplies and includes a storage scheme, while the other is for a much broader treatment of the desert watershed with rock salt. Reuse of waste water is being investigated at the Tucson Sewage Treatment Plant. In Puerto Penasco, Mexico, research has shown that it may be possible to produce electricity, freshwater and food economically as a package unit in arid coastal zones. Other important alternatives studied centered on increasing irrigation efficiencies, which are presently estimated at only 50 per cent. Reasons why large-scale water transfers may become economically feasible in the future and reasons for continuing studies into that feasibility and alternatives to water transfer are outlined. (See W69-09210). (Sherbrooke-Ariz)
W69-09225

AIRBORNE INFRARED RADIOMETER INVESTIGATION OF WATER SURFACE TEMPERATURE WITH AND WITHOUT AN EVAPORATION-RETARDING MONOMELECULAR LAYER,
Colorado State Univ, Fort Collins. Dept. of Atmospheric Science; and Wave Propagation Lab., Boulder, Colo.
R. L. Grossman, B. R. Bean, and W. E. Marlatt.
J Geophys Res, Vol 74, No 10, p 2471-2476, May 15, 1969. 6 p, 5 fig, 2 tab, 6 ref.

Descriptors: *Remote sensing, *Surveys, *Infrared radiation, *Monomolecular films, *Oklahoma, Evaporation, Summer, Instrumentation, Alcohols, Statistical methods, Humidity, Computer programs, Winds, Air-water interfaces, Evaporation control, Water temperature.
Identifiers: *Infrared radiometer measurement, *Lake Hefner, Okla.

Water surface temperature measurements of Lake Hefner, Oklahoma were made August 17-30, 1966 by using an airborne infrared radiometer and the results so obtained were compared with those obtained by a boat radiometer and a floating thermistor. The study shows an average duirnal variation of about 1 deg C for late summer conditions. The lake surface was 0.4 deg to 0.9 deg C cooler than the water about 1 cm below the surface because of cooling by evaporation. Applications of an evaporation-reducing monomolecular film reversed the observed temperature under the monomolecular layer was 0.3 deg C warmer than in the surrounding open water. The comparison of the observations made by the aircraft boat, and floating radiometers shows the reliability of airborn temperature surveys. (Gabriel-USGS)
W69-09253

PREDICTION OF WATER YIELD IN HIGH MOUNTAIN WATERSHEDS BASED ON PHYSIOGRAPHY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Robert W. Julian, Vujica Yevjevich, and Hubert J. Morel-Seytoux.
Colo State Univ Hydrol Paper No 22, Aug 1967. 21 p, 9 f ig, 4 tab, 28 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Runoff forecasting, *Statistical methods, *Topography, Statistical models, Model studies, Water yield, Water resources development, Weather modification, Colorado River Basin.
Identifiers: *Watershed analysis, Watershed models, Physiography.

A statistical method is presented that permits the estimation of yield of high mountain watersheds in terms of physiographic characteristics evaluated from maps. The method is advantageous because it does not require the knowledge of the climatic or hydrologic characteristics of the basin or of the region. The method is, however, limited to regions of reasonable climatic and hydrologic homogeneity. The applicability of the method is illustrated for several regions in the Upper Colorado River Basin. A coefficient of determination as high as 77% is obtained in the best case. In the worst result the coefficient falls below 50%. The estimate of specific yield is valuable for many applications. It provides, in particular, a means of deciding upon the suitability of basins to weather modification programs. (Knapp-USGS)
W69-09293

3C. Use of Water of Impaired Quality

FUTURE USE OF DESERT SEACOASTS,
For primary bibliographic entry see Field 03A.
W69-09211

A WATER-QUALITY HIERARCHY FOR ARID LANDS,
North Carolina Univ., Chapel Hill. School Public Health.
For primary bibliographic entry see Field 05D.
W69-09213

WARM-WATER IRRIGATION: AN ANSWER TO THERMAL POLLUTION,
SCIENCE, Washington, D.C.
For primary bibliographic entry see Field 05B.
W69-09301

MUSKEGON COUNTY PLAN FOR MANAGING WASTE WATER.
Muskegon County Board of Supervisors; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05D.
W69-09331

3E. Conservation in Industry

WATER REQUIREMENTS AND USES IN WYOMING MINERAL INDUSTRIES,
Bureau of Mines, Denver, Colo. Dept. of Engineering.
For primary bibliographic entry see Field 06D.
W69-09294

PERCEPTION OF CHOICE AND FACTORS AFFECTING INDUSTRIAL WATER SUPPLY DECISIONS IN NORTHEASTERN ILLINOIS,
Chicago Univ., Ill. Dept. of Geography.
Shue Tuck Wong.
Department of Geography Research Paper No 117, University of Chicago, 1969. 93 p, 37 ref, 93 p.

Descriptors: *Decision making, *Water management (Applied), *Industrial use (Water), *Industrial plants, Water supply, Water shortage, Water conservation, Water rates, Water sources, Economic efficiency, Legal aspects, Recirculated water.
Identifiers: Northeastern Illinois Metropolitan Area, Cook County.

Intake of water by similar industrial plants often varies even when conditions of quality and quantity are stable. The purpose of this study is to explore the possible role which perception of the range of adjustments plays in industrial water supply management. The range of adjustments includes: recycling, re-use, elimination of losses, substitution process changes. A decision by an industrial manager as to what adjustments or combination of adjustments to adopt varies, depending on conditions under which the choice is exercised. These may include: (1) Type of industry, (2) age of plant, (3) temporal lapse, (4) size of plant, (5) sources of water supply, (6) experience of a water shortage, (7) price of public water, (8) increase in the cost of water, (9) cost of treatment, (10) need for quality control, (11) rates of repayment investment in conservation equipment, (12) legal restrictions, (13) experience of manager, and (14) sources of information. Through use of questionnaires and analysis of 35 case studies, some patterns of perception and choice of adjustments were found. The conditions under which choice adjustments are exercised, are primarily economic-technologic and partly that of water supply and temporal lapse, all affected by social guides. There was also a correlation between perception and adoption, that is, those managers who perceived became adopters and those who adopt also perceive a wider range of adjustments than those who do not. (Marriott-Chicago)
W69-09322

3F. Conservation in Agriculture

CONSERVATION OF WOODLAND AREAS.
For primary bibliographic entry see Field 06E.
W69-09081

OPTIMIZATION OF WATER PLANNING USING A SPECIAL PURPOSE COMPUTER,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering; and Elbit Computers Ltd., Haifa (Israel).
For primary bibliographic entry see Field 06A.
W69-09367

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

COMMONWEALTH V GORHAM (SUIT TO COMPEL LAND OWNER TO REINSTATE DRAINAGE SYSTEM).

56 Lackawanna Jurist 189-194 (Pa CP 1955).

Descriptors: *Pennsylvania, *Surface drainage, *Highways, *Obstruction to flow, Roads, Surface water, Surface runoff, Natural streams, Watercourses (Legal), Drainage systems, Subsurface drainage, Drainage water, Repulsion (Legal aspects), Pipes, Ditches, Watersheds (Basins), Legal aspects, Judicial decisions.
Identifiers: Injunction (Mandatory).

Defendants bought land across which ran a natural drainage ditch. This ditch had conducted waters, f lowing across and under an adjacent highway, to a creek in the back of defendants' property. In building a home on the property defendants filled in a catch basin and said drainage ditch causing water to collect under and on the other side of the highway. The state sought an injunction to force defendants to replace the drainage ditch so as to allow the drainage of surface waters. In fi nding for the plaintiff the court held that the arbitrary filling in of a ditch, which had carried off the waters of a hi ghway for 60 or 70 years, without providing for proper drainage of the water from the highway, constituted a continuing nuisance which would be restrained and defendants were ordered to provide for such drainage. The court also took note of the fact that proper drainage could have been provided by the installation of a subterranean pipe from the catch basin to any point across defendants' land. (Logan-Fla)
W69-09069

INVESTIGATION OF HIGH AND LOW LEVELS.

NH Rev Stat Ann secs 482:1, 482:2 (1968).

Descriptors: *New Hampshire, *Dams, *Maintenance, *Water levels, Administrative agencies, Administration, Legislation, Water law, Water policy, Legal aspects, Regulation, Water rights, Decision making, Standards, Investigations, On-site investigations, Planning, Evaluation, Hydrolic data, Inspection, Flood control, Public benefits, Public health.

In the interest of public good the water resources board makes such inspections with respect to high or low water levels in the inland public waters of the state and the rights, instrumentalities and practices whereby such levels are affected or controlled which best promote the public health, safety, enjoyment and value of public waters. Records of water flow and the like must be made available to the board after a reasonable request of same so that owners and managers of dams may be advised of the need for variations of run-off and so that they may better plan for and anticipate emergencies. The board calls conferences with dam owners for the purpose of obtaining cooperation in the regulation of stream flow to minimize damage to public and private property at times of high water. Any time the board feels that public health or safety may be jeopardized it recommends action concerning storage or release of water as it deems necessary. (Johnson-Fla)
W69-09090

PUBLIC SERVICE COMPANIES.
SC Code Ann, secs 58-967, 58-991, 58-992 (1962).

Descriptors: *South Carolina, *Railroads, *Culverts, *Drainage, Legislation, Regulation, Bridges, Bridge construction, Damages, Floodwater, Administrative agencies, Navigable waters, Tidal waters.
Identifiers: *Railroad crossings.

Landowners may recover damages from railroad corporations for all injuries caused by the wrongful obstruction of watercourses by such corporations and it shall not be necessary to allege or prove negligent construction of any works of such corporation. Public Service Commission shall control, by special order, the manner in which any street or railroad track crosses any railroad track so as to effect proper drainage of adjacent territory. No railroad shall be constructed to cross another railroad at the same level or across navigable or tidewaters without the written consent of the Public Service Commission, nor except in the manner it shall prescribe. (Kahle-Fla)
W69-09095

ARKANSAS POWER AND LIGHT CO. V CASH (OPERATION OF DAMS IN FLOODS).

432 SW 2d 853-861 (Ark 1968).

Descriptors: *Arkansas, *Flood damage, *Flood control, *Reservoir operation, Discharge (Water), Judicial decisions, Dams, Floodgates, Watershed management, Water levels, Lakes, Rivers, Flood forecasting, Reservoirs, Weather forecasting, Floods, River forecasting, Surface runoff, Crops, Electric powerplants, Watercourses (Legal), Legal aspects.
Identifiers: Crops damage, River bottom lands, Sour crops.

Plaintiffs and other farmers owned land on a certain river below two dams owned by defendant. Flood waters produced by a sudden rainstorm overflowed plaintiffs' lands and caused their crops to sour. Plaintiffs claimed that defendant's negligent operation of the dams caused the floodwaters to remain on the land longer than normal causing the souring of the crops. The court held that even if defendant had been negligent, the evidence did not show that his negligence was the cause of the plaintiffs' damages. The evidence did show that defendant had discharged water from the dams in such a manner as to prevent higher flood levels. This method of discharge did cause floodwaters to remain on plaintiff's land longer. However, the court found that there was no evidence to show that if another method of discharge had been used the crops would not have been destroyed. The court felt that the crops might have been destroyed if water had been left on the crops a much shorter time. The defendant may have been negligent in not using weather forecasts and discharging water in relation to their predictions, but the court felt this negligence could not be shown to be the cause of plaintiffs' damages. Defendant received a directed verdict. (Gadd-Fla)
W69-09103

EDWARD V MASSETT (IMPROVEMENT OF STREAM AS DRAINAGE OUTLET).

164 NW 2d 382-386 (Minn 1969).

Descriptors: *Minnesota, *Natural flow, *Drainage systems, *Outlets, Stream flow, Flow, Channels, Streams, Riparian land, Riparian rights, Eminent domain, Compensation, Floods, Runoff, Stream erosion, Erosion, Judicial decisions, Drains, Damages, Water law, Ditches, Riprap, Legislation.
Identifiers: Constitutional law.

Petitioners owned land abutting on a natural stream forming the outlet for numerous drainage ditches. Petitioners claimed the stream was of insufficient capacity to carry the water from all the ditches and, as a result, caused inundation and erosion of their land. They brought an action seeking enlargement and deepening of the stream. An engineer was appointed to make a study. He recommended two alternative plans to improve the stream. The trial court rejected both plans, one as being ineffective and the other as being too costly. Petitioner appealed on constitutional due process grounds, contending that the flooding and erosion resulted in a taking of land without just compensation. The supreme court affirmed holding that since petitioners could have objected to the construction of the ditches on the grounds of the inadequacy of the outlet when the drainage system was being

established, they could not later claim a constitutional right to the improvement. (Helwig-Fla)
W69-09106

FLOODS, STREAMS, AND DRAINAGE.

Vt Stat Ann tit 19, secs 1231-1232, 1251-1252, 1271-1273, 1291-1296 (1968).

Descriptors: *Vermont, *Administrative agencies, *Local governments, *Water policy, Legislation, Water law, Legal aspects, Jurisdiction, Drainage, Ditches, Flood routing, Floodwater, Controlled drainage, Eminent domai n, Highways, Highway relocation, Embankments, Road construction, Bridges, Flood control, Civil engineering, Drainage systems, Flood damage, Flow control.
Identifiers: Damages, Adjudication procedure, Compensation, Public health.

Selectmen may change the location of a bridge, if such bridge is swept away by a flood, to a location which is less exposed but must assess and tender compensation to persons injured by such relocation. To protect a highway from damages due to flood waters or ice jams the course of a stream may be diverted by the selectmen or road commissioners. Persons dissatisfied with such a decision may ask the county court for a new hearing on the matter. When embankment of a stream is necessary to protect a highway under construction or repair and the owner of the property over which the stream flows asks for excessive compensation for allowing same, the selectmen must determine the necessity of such embankment and then, if necessary, assess reasonable damages. The selectmen are also responsible for location, establishment and construction of appropriate drains, ditches and watercourses as are deemed necessary for t he public health within their jurisdiction and are responsible for paying appropriate damages to landowners who are injured by such actions. If such a landowner is not satisfied by the damages thus awarded, he may petition a district judge for a reappraisal of the damages. (Johnson-Fla)
W69-09116

ILLINOIS AND DESPLAINES RIVERS.

I ll Ann Stat ch 19, secs 38-41 (Smith-Hurd 1963).

Descriptors: *Illinois, *Navigable rivers, *Channel improvement, *Navigation, Dams, State governments, Federal government, United States, Administrative agencies, Channels, Lake Michigan, Water supply, Rivers, Navigable waters, Streams, Obstruction to flow, Legislation, Legal aspects, Water law, Water policy, Grants.
Identifiers: Slack-water.

The State Works at Henry and Copperas Creek and the river now slack-watered by said works, are hereby ceded to the United States on the condition that existing dams be removed whenever sufficient depth for navigation can be secured through channel improvement. If acceptance of the said works on this condition does not occur within 4 years after this act becomes law, the Illinois Department of Public Works is authorized to remove the dams at Henry and Copperas Creek. This act of cession is based upon the condition that the plan of improving navigation in the Illinois River by dams and locks be changed to a plan of improvement by an open channel in conjunction with a water supply from Lake Michigan. The DesPlaines and Illinois rivers are hereby recognized as and declared to be navigable streams. Explicit authority from the General Assembly is necessary for the erection of any structure in or across said streams. The Governor and General Assembly are hereby authorized and directed to take the legal actions necessary to remove all and every obstruction in said rivers that interfere with the intent and purpose of this act. (Carruthers-Fla)
W69-09119

PROPAGATION OF THE FLOWS DISCHARGED BY THE 'GHEORGHE GHEORGHIU-DEJ' HYDROELECTRIC PLANT IN THE ARGES RIVER BED (ROMANIAN),
Institute of Hydrotechnical Research, Bucharest (Rumania).
Romeo Amaftiesei, and Gheorghe Popa.
Hidrotechnica, Gosp Apelor, Meteorol, Vol 13, No 5, p 238-243, May 1968. 6 p, 11 fig, 4 ref.

Descriptors: *Discharge measurement, *Hydroelectric plants, *Hydrologic data, Rivers, Infiltration, Seepage, Hydraulic properties, Porosity, Permeability, Gravels, Sands, Bank storage.
Identifiers: *Romania, Arges River flow.

The hydrologic regime of Arges River underwent important changes as a result of discharges from the 'Gheorghe Gheorghiu Dej' hydroelectric plants. Field studies were conducted between July 20-22 and Aug 1-2, 1967 to determine how the discharged water from the plant was propagated in the Arges River. Measurements were made on the evacuation channels of the hydroelectric plants and in 3 additional points along the river course. It was observed that an increase in flow downstream was accompanied by a corresponding reduction in the flow volume. This phenomenon was explained by lateral infiltration of water into the river banks. The variations of water level in observation wells confirmed the above hypothesis. Large amounts of water are stored in highly porous gravels and sands during the high flow. The water flows back into the river when the water level in the river decreases. The amount of water stored in the river banks was calculated by using a mathematical formula in which water level, infiltration coefficient, and active porosity of river banks were used. Wave attenuation was also calculated by using longitudinal and transversal profiles between Oesti and Malu Spart. (Carstea-USGS)
W69-09166

TIME LAPSE AERIAL PHOTO ANALYSIS OF THE CONNECTICUT RIVER FROM 1952 TO 1965,
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
For primary bibliographic entry see Field 07B.
W69-09243

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN FLORIDA.
Corps of Engineers, Atlanta, Ga. South Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 88 p, 47 photo, 2 maps, index.

Descriptors: *Water management (Applied), *Florida, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training, Canals.
Identifiers: U.S. Army Corps of Engineers projects (Fla).

U.S. Army Corps of Engineers water resources development project in Florida are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects is outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-09262

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY OF ENGINEERS IN MINNESOTA.
Corps of Engineers, Chicago, Ill. North Central Div.
Corps Eng Water Resources Develop Rep, Jan 1, 1969. 56 p, 3 fig, 20 photo, 1 map, index.

Descriptors: *Water management (Applied), *Minnesota, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Minn).

U.S. Army Corps of Engineers water resources development projects in Minnesota are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects is outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-09263

HYDRAULIC ENGINEERING (HUNGARIAN),
A. Filipkowski, N. Laszlo, Z. Zorkoczy, O. Radai, and A. K. Basu.
Vizugyi Kozlemenyek, Lapkiado Vallalot, Budapest, Issue No 1, 1969. 186 p, 68 fig, 12 tab, 208 ref.

Descriptors: *Water utilization, *Water balance, *Slope stability, *Streamflow, *Karst, *Dams, Landscaping, *Pollution abatement, *Instrumentation, Snowmelt, Hydraulic engineering, Reservoir construction, Water users.
Identifiers: *Poland, *Hungary, Water problems.

This volume of 186 pages consists of 10 articles and reviews by Hungarian, Polish, and other writers discussing various hydrologic problems and water utilization on the basis of hydrogeological and hydraulic engineering data and considerations. The volume contains the following articles: (1) Contemporary problems of water-household balance in Poland by Filipkovski, Andrzei; (2) Hydraulic problems in slope stability, by Nagy Laszlo; (3) Regulation of the Hungarian Upper Danube, by Zorkoszy, Zoltan; (4) Interpretation of aerial photographs in karstic-water research, by Radai, Odon; (5) Construction of a barrage in the mouth of the Eider River, by Kezdi, Arpad; (6) Landscaping along surface waters, by Hazslinsky, Tamas; (7) Industrial pollution of the Darnoda River (India), by Basu, A. K.; (8) New measuring instruments and methods in the hydrological observation network, reviewed after R. W. Carter by E. Varsa; (9) Runoff from snowmelt water, reviewed after F. A. Bertle by M. Hegedus; and (10) The largest navigation lock of the World, in Belgium, reviewed by G. Kontur. (Gabriel-USGS)
W69-09266

FLOOD PLAIN INFORMATION, SOUTH FORK ZUMBRO RIVER AND TRIBUTARIES, ROCHESTER, MINNESOTA.
Corps of Engineers, St. Paul, Minn.

Corps Eng Flood Plain Rep, Aug 1968. 104 p, 32 fig, 40 plate, 20 tab.

Descriptors: *Floods, *Flood damage, *Minnesota, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Rochester (Minn), Standard project flood, Intermediate regional flood.

Flooding of South Fork Zumbro River, Rochester, Minnesota is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)

W69-09286

CERTAIN LOCAL PROVISIONS (FORMATION OF DRAINAGE DISTRICTS).

SC Code Ann secs 18-751 thru 18-760 (1962).

Descriptors: *South Carolina, *Drainage, *Drainage districts, *Local governments, Riparian land, Streams, Swamps, Reservoirs, Lakes, Dams, Basins, Canals, Drains, Ditches, Federal government, Construction, Paving, Sewage districts, Cities, Cost sharing, Road construction, Contracts, Administrative agencies, Bridges, Legislation, Obstruction to flow.
Identifiers: Dragline, Counties, Obstruction to drainage, Penalties (Criminal), Competitive bidding, Notice.

Contiguous landowners in Anderson County on a stream on which there is a swamp, may form a drainage district to rid themselves of such swamp. If feasible, they may construct a lake or dam instead of draining such swamp. Any person obstructing drainage in Charleston County is subject to fine or imprisonment. The governing body of Charleston County may cooperate with federal agencies in the construction and paving of drainage and sewer projects in municipalities, if the municipality provides at least half the necessary funds. The governing body of Charleston County shall not enter any contract for drainage work unless sealed competitive bids are first received. A drainage commission is established in Georgetown County which shall have supervision of the county dragline and shall designate the areas of the county to be drained. (Shevin-Fla)
W69-09348

DRAINAGE DISTRICTS UNDER 1920 ACT.

SC Code Ann secs 18-421 thru 18-432, 18-441 thru 18-463 (1962).

Descriptors: *South Carolina, *Drainage districts, *Administrative agencies, *Drainage practices, Jurisdiction, Local governments, Legislation, Water law, Water policy, Legal aspects, Political aspects, Land management, Drainage, Conservation, Land, Land classification, Land development, Land forming, Land reclamation, Flood control, Reclamation, Riparian land, Financing, Assessments, Drainage programs.

Drainage districts may be formed by the State Budget and Control Board or a majority, in numbers or in acreage, of the holders of any contiguous body of swamp, wet or overflowed lands for the purpose of having such lands reclaimed and protected from the effects of water by drainage or otherwise. Before the formation of any drainage district, en election must take place in which a majority of the freeholders of the land which is to be embraced in the district must approve the additional assessment, levy of taxes and issuance of bonds. Also prerequisite to formation of such a district is a petition signed by a majority of the freeholders within the proposed district which must be filed in the appropriate court of common pleas. If objections are overruled and the court finds the proposal to be beneficial to the public health, convenience or welfare, the district is declared a corporation. In a meeting of the local landholders, supervisors for the district are elected and they in turn must appoint a number of administrative personnel including an engineer, a treasurer and overseers. (Johnson-Fla)
W69-09361

THE APPLICATIONS OF THE TECHNIQUES OF SPACE TECHNOLOGY TO WATER RESOURCE CONTROL,
TRW Systems, Redondo Beach, Calif.; and TRW Systems, Houston, Tex.
For primary bibliographic entry see Field 06A.
W69-09368

OPTIMAL CONTROL OF A STORAGE RESERVOIR DURING A FLOOD SEASON,
Technion - Israel Inst. of Tech., Haifa.
Oded Levin.
IFAC, Haifa Symp, Comput Contr Nat Resources, Public Util, September 1967. 20 p, 2 fig, 4 ref.

Descriptors: *Optimization, *Control systems, *Flood forecasting, *Reservoir storage, *Overflow, Risks, Markov process, Mathematical models, Water level fluctuations, Transition flow, Water supply.

The study considered the deriving of optimal operating rules for regulating the outflow from a reservoir during a flood in order to minimize water losses due to spills while not exceeding a specified probability that an overflow would occur. A mathematical Markov model was formulated for analyzing the problem. The optimal control functon for the fld season was established and the transition probabilities between each subsequent periods could be computed. Using a Markov chain procedure and proceeding in a chronological order the elements of the seasonal transition probability matrix were computed. The solution provided rules also for continuous control of the outflow from the reservoir as a function of time, water level and any other information concerning the system's state. (Thiuri-Cornell)
W69-09370

THE STATE NAVIGATION SERVITUDE,
Daniel J. Morgan, and David G. Lewis.
Land and Water L Rev, Vol 4, No 2, p 521-538, 1969. 18 p, 85 ref.

Descriptors: *Riparian rights, *Navigable waters, *Condemnation, *Compensation, Legal aspects, Ownership of beds, Easements, State governments, Banks, High water mark, Civil law, Water law, Public benefits, Public rights, Beds under water, Legal aspects, Riparian land.
Identifiers: Navigational servitude.

The state navigation servitude is an exception to the rule that private property cannot be taken by the state without just compensation. The state can limit or take riparian rights of private property owners under this servitude. The theory behind the taking is that the state holds an easement over the navigable waters and their beds for the public to use for navigation. Thus, as long as the taking can be shown to be for the purpose of navigation the state has no obligation to pay compensation. There are three main views of the state navigational servitude. One group of states follows the 'general rule' which allows states to take riparian rights if the taking is to aid navigation. But just compensation is due the riparian owner if the taking is for any other purpose. Another group of states follows the 'public purpose exception to the general rule' which allows the states to extend the no-compensation aspect of the navigation servitude to any government project purposes. The 'Louisiana exception to the general rule' developed from civil law which grants the state an easement to the banks of the upland property owners. The easement includes projects for navigation and extends to such things as levees and roads. (Gadd-Fla)
W69-09377

PORT DISTRICTS.

Mich Comp Laws secs 120.1 thru 120.56 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Port authorities, *Harbors, *Navigable waters, Legislation, Administrative agencies, Construction, Taxes, Piers, Docks, Canals, Locks, Watercourses (Legal), Operation and maintenance, State governments, Artificial watercourses, Leases, Financing, Local governments, Bonding, Legal aspects, Regulation.
Identifiers: *Port districts, Ferries.

The creation of port districts in various counties of the state is herein authorized. These districts shall have all the powers specifically granted to them and any powers implied or necessary for the exercise of the powers specifically granted. Procedures are provided for the establishment of the district. The appointment and duties of a port commission are provided for. Each port district shall have the power to construct, acquire, maintain, and operate seawall jetties, piers, wharves, docks, ferries, canals, locks, and seaways. The district may also regulate the construction of structures in navigable waters. Each port commission may create and improve any waterways for harbor purposes and regulate and control all such waterways and all natural or artificial waterways within the limits of the district. The district is also given the power to levy taxes, lease or sell property, and issue bonds. (Heckerling-Fla)
W69-09380

UNITED STATES V 2,648.31 ACRES OF LAND (CONDEMNATION OF FLOWAGE RIGHTS).

218 F 2d 518-524 (4th Cir 1955).

Descriptors: *Eminent domain, *Easements, *Flooding, *Property values, Flood control, Federal government, Dams, Multiple-purpose projects, Condemnation, Compensation, Damages, Flood damages, Run off, Reservoirs, Terrain analysis, Dam design, Judicial decisions, Legal aspects, United States.
Identifiers: *Flowage easements.

Appellees owned land part of which was to be subject to intermittent flooding in connection with a flood control dam. In an action to condemn a flowage easement over the land appellees recovered the fee simple value of the land. The trial court excluded testimony tending to show that not all the land would be permanently flooded. The government appealed contending that an improper measure of damages had been used. The court of appeals reversed the lower court, holding that the measure of damages for taking of flowage rights must be construed in connection with the particular project. Where it can be shown that land upon which there are flowage rights will be flooded only intermittently and the landowner would still have substantial use of the land, this evidence should be admitted. The measure of damages would be the difference in the value of the land before and after condemnation of the flowage easement. The landowner would have the right to recover further damages if in the future there was further flooding from a change in the operation of the dam project. (Helwig-Fla)
W69-09383

RUSSELL FORK COAL CO V HAWKINS (LIABILITY FOR FLOODING CAUSED BY STRIP MINING).

311 Ky 449, 223 SW 2d 887-892 (1949).

Descriptors: *Kentucky, *Strip mines, *Excessive precipitation, *Flood damage, Legal aspects, Flash floods, Obstruction to flow, Retaining walls, Strip mine wastes, Judicial decisions, Floodwater.
Identifiers: *Debris, *Negligence.

Plaintiffs sued for damages allegedly caused by defendant's negligent strip mining operation. Plaintiffs contended defendant excavated three or four acres to mine coal and cast the debris from this excavation into the head of a creek below the mountain. The excavation filled with water, and plaintiffs alleged heavy rains broke an earth retaining wall. The subsequent flow of water into the creek below carried the debris in a flood crest which damaged plaintiff's property. The jury in the circuit court gave judgment for plaintiff in the sum of $10,000. On appeal, the court of appeals reviewed extensive testimony concerning the volume of rainfall, damages and nature of the flooding and held that the evidence did not support a conclusion that water in the excavation caused the damage complained of. Even if filled to capacity the excavation

water would have been of negligible effect as compared to the total volume of rainfall which caused the flood. The court reversed the judgment for plaintiffs. (Harris-Fla)
W69-09384

CONSTRUCTION OF DRAINAGE SYSTEMS.

Minn Stat Ann secs 106.021, 106.031, 106.071 thru 106.211 (1964), as amended, (Supp 1969).

Descriptors: *Minnesota, *Drainage systems, *Local governments, *Engineering, Ditches, Lakes, Channels, Eminent domain, Riparian rights, Lakes, Administrative agencies, Flood control, Water law, Legislation, Surveys, Projects, Drains, Drainage, Benefits, Damages, Engineers estimates, Maintenance, Construction, Public benefits.

The county boards and the district courts shall have power to make all necessary orders for and require: (1) construction and maintenance of public drainage systems; (2) drainage of lakes; and (3) flood control. Before any public drainage system is established a petition therefor, signed by a majority of landowners to be effected shall be filed. The system must be for the public benefit and welfare. After the petition is filed the board shall appoint an engineer to make a survey of t he proposed system. The engineer shall make a preliminary survey and report his proposals thereon. After the filing of the engineers report, there shall be a hearing upon his proposals, notice thereof being sent to all interested persons. The board or court may approve the plan if it is determined to be for the public benefit. The engineer shall then proceed with a detailed survey including maps showing all details of the system, plans for bridges, soil surveys, and specifications. The board shall appoint disinterested viewers to determine the benefits or damage to land, and they shall report their findings. Benefit assessments and damages shall be based upon such reports. (Helwig-Fla)
W69-09385

ABANDONMENT OF HIGHWAY FOR CONSTRUCTION OF DAM; ACQUISITION OF LAND.
Conn Gen Stat Ann sec 13a-54, 13a-72, 13a-73, 13a-75 (1958).

Descriptors: *Connecticut, *Dam construction, *Highway relocation, *Condemnation, Road construction, Dams, Eminent domain, Compensation, Access routes, Right-of-way, Highways, Backwater, Flooding, Flood damage, Real property, Property values, Legislation, Legal aspects, Damages.

Any person or corporation who wishes to construct a dam which will cause any highway to be flooded and abandoned must reach a written agreement with the parties liable for maintaining that highway. This written agreement must be recorded in the court clerks office of the town or towns where the highway to be abandoned is located. If no agreement can be reached, the superior court of a county in which the highway is located may grant permission to flood the highway and award damages to the parties liable for maintaining the highway. Likewise, the highway may be relocated upon written recorded agreement between the parties involved or, if no agreement can be reached, upon the order of a superior court. The commissioner may take or purchase all lands necessary for the construction of highway drainage systems. The owners of such lands shall be paid damages as assessed by the commissioner. Land damaged by flood or other natural disaster shall be given a value as if it had been restored to full productive use. (Gabrielson-Fla)
W69-09386

DRAINING LANDS.
Md Ann Code Art 25, secs 52-95 (1957).

Descriptors: *Maryland, *Drainage districts, *Drainage programs, *Surface drainage, *Land reclamation, Local governments, Right-of-way, Controlled drainage, Ditches, Canals, Culverts, Drainage engineering, Easements, Condemnation, Damages, Flood control, Water management (Applied), Legal aspects, Legislation, Construction, Drainage systems.

Authority is granted to the boards of county commissioners to establish public drainage associations for the purpose of draining swampy lands and lands subject to overflow. The commission operates through a board of drainage viewers which, in turn, appoints a board of managers for each improvement project. The title provides for the acquisition of rights-of-way and easements needed to carry out drainage projects, the funding of these projects, and the composition and duties of the boards of drainage viewers and the board of managers for each drainage district. (Kelly-Fla)
W69-09387

DRAINING LANDS.
Md Ann Code Art 25, secs 87 to 95 (1957).

Descriptors: *Maryland, *Drainage districts, *Drainage programs, *Surface drainage, Land reclamation, Controlled drainage, Drainage engineering, Drainage systems, Local governments, Legislation, Legal aspects, Flood control, Ditches, Canals, Culverts, Construction.

The board of managers of each drainage district may employ laborers and purchase or rent machinery to carry out improvements. The board is charged with maintaining drainage improvements in good repair and may levy a drainage tax for this purpose on the lands benefited. Authorized improvements which would interfere with, or cause removal of, any milldam, or divert water so as to deprive the owner of a milldam of its use, may not be constructed. Obstructing the flow of water through any ditches or other improvements made pursuant to this title is a misdemeanor and is punishable by fine. Where improvements are constructed so as to cross public highways at intersections with natural watercourses, the costs of culverts and bridge enlargements must be borne by the highway authority. Where there is no intersection with a natural watercourse, the drainage association must assume the costs. A majority of the landowners in a public drainage association may petition the board of county commissioners for dissolution of the association. (Kelly-Fla)
W69-09388

DUTIES OF DEPARTMENT OF CHESAPEAKE BAY AFFAIRS.
Md Code Ann art 14B, secs 12-13 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Navigation, *Administrative agencies, *Tidal waters, Federal government, State governments, Legislation, Boats, Boating, Harbors, Rivers and Harbors Act, Wastes, Channels, Engineering structures, Dredging, Water districts, Public benefits, Taxes, Regulation, Control, Legal aspects, Cooperation, Water pollution control, Projects, Construction, Financing.
Identifiers: *Chesapeake Bay, *Obstruction of navigation, Towing, US Army Corp of Engineers, Penalties (Civil).

The Department of Chesapeake Bay Affairs is charged with the duty of enforcing any laws applicable to boats using the waters of the state. Its other duties include clearing the waters of logs and other debris which constitute obstructions to navigation and cooperation with federal, state or local agencies which make funds available for its operation. The Department shall tow disabled vessels to the nearest harbor but shall not compete with commercial towing services. It is unlawful for any person to deposit refuse on any waters of the state. The Department shall mark channels in the waters of the state. The Department may establish areas as waterways improvement districts. The Department is to provide liason with the United States Army Corp of Engineers on projects under the Rivers and Harbors Act. It may construct marine facilities beneficial to the boating public. Projects may be financed by special assessments levied against property owners in the district. Any person violating any section of the article is guilty of a misdemeanor. (Shevin-Fla)
W69-09390

DRAINAGE DISTRICT UNDER 1920 ACT.

SC Code Ann secs 18-541 thru 18-579, 18-591 thru 18-599, 18-611 thru 18-616, 18-621 thru 18-638 (1962).

Descriptors: *South Carolina, *Drainage districts, *Drainage systems, *Taxes, Legislation, Drainage, Local governments, Drainage programs, Land, Land tenure, Construction, Construction costs, Assessments, Canals, Ditches, Drains, Boundaries (Property), Watercourses (Legal), Excavation, Bridges, Condemnation, Financing, Operation and maintenance, Bonding, Legal aspects, Administration.

Land within a drainage district shall be taxed proportionately to the benefits it will receive. Delinquent lands may be sold to satisfy the taxes. Bonds may be issued to meet the costs of construction. Funds derived from the sale of such bonds shall be used to pay the cost of the drainage works. A maintenance tax may be levied on land to maintain drains, ditches, or other improvements. Landowners may petition for a readjustment of the tax and a hearing will be held to determine whether such readjustment will take place. The supervisors of the district may petition the court for an order extending its boundaries. Previous drainage systems in the district may be connected with the new system. Any landowner may construct a bridge over any drain, ditch, canal, or excavation. (Shevin-Fla)
W69-09393

DAMS AND DRAINS.
SC Code Ann Secs 18-201 thru 18-205 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Drainage districts, *Regulation, Water law, Water policy, Legal aspects, Legislation, Local governments, Administration, Flood control, Drainage, Multiple-purpose projects, Project purposes, Projects, Reclamation, Surface drainage, Tidal marshes, Public benefits, Public health.

Drainage of swamps, drainage of surface water from agricultural lands and reclamation of tidal marshes are considered public benefits and conducive to the public health. This chapter shall be liberally construed to promote the leveeing, ditching, draining and reclamation of wet overflowed lands. This chapter has no effect on local drainage laws enacted by the General Assembly. The clerk of the court of common pleas keeps the 'Drainage Record' in which every petition, motion, judgment, and order of the board in every drainage transaction which may come before it is recorded. (Johnson-Fla)
W69-09394

TAX DITCHES.
Del Code Ann tit 7, secs 4171-4182 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Drainage, *Taxes, Assessments, Administration, Costs, Operating costs, Tax rate, Legislation, Legal aspects, Water law, Financing, Budgeting, Ditches, Drainage districts, Drainage practices, Drainage programs, Maintenance.
Identifiers: *Tax ditches.

The County Board of Assessments keeps a current assessment list in a special assessment book of all

tax ditches formed under this chapter and is assisted by the state drainage engineer in making such appropriate changes in the special ditch assessment books as are warranted by transfers of property located therein. The tax is based on the ratio between the assessment lease for each parcel of property and the total assessment base for the tax ditch. These taxes are collected by the Receiver of Taxes and County Treasurer and are put in separate accounts to be drawn by officers of the respective ditch companies from which the taxes come. Loans may be secured by a tax ditch upon a pledge of the tax warrants from such ditch. Subject to state and county taxes, all taxes levied under this chapter are paramount over other liens on the property taxed. With the consent of the County Soil Conservation District ditch managers may regulate the amount of tax necessary to defray the cost of annual maintenance on such ditches. (Johnson-Fla)
W69-09397

ALLEN V NEW YORK STATE WATER RESOURCES COMM'N (DAMAGE FROM DAM CONSTRUCTION).

299 NYS 2d 586-589 (1969).

Descriptors: *New York, *Dam construction, *Administrative agencies, *Competing uses, Property values, Public rights, Jurisdiction, Damages, Legislation, Water law, Legal aspects, Water policy, Project purposes, Riparian rights, Water rights, Artificial use, Civil law, Relative rights, Riparian waters, Riparian land, Regulation, Public health.

Petitioners brought suit in the Albany Supreme Court to obtain a judgment annuling the determination of respondent Water Resources Commission that a dam might be constructed on the Cayuta Lake Outlet. Petitioners alleged that private damages would follow which would diminish the value of their lands. Under conservation law regulations the Commission must determine whether such construction is contrary to the public interest and whether it would endanger the public health, safety and welfare or the state's natural resources. The Commission made the determination that the public requirements were met, but did not determine the relative merits of t he private interests involved. Pursuant to their finding the Commission did not establish a lake level or mandate the construction of a dam but merely found that no public interest would be violated by a dam with a crest not above a certain elevation. The court held in affirming the Commission's finding that, while there is still recourse through the courts for private injuries, the Commission's finding that the project was not contrary to public interest was within the scope of its authority. The proceeding was dismissed. (Johnson-Fla)
W69-09399

GRATHWOHL V HIWAY WONDERLAND INC (FLOOD DAMAGE FROM LOWER RIPARIAN DAM).
298 NYS 2d 1020-1021 (NY App Div 1969).

Descriptors: *New York, *Dams, *Riparian rights, *Remedies, Relative rights, Judicial decisions, Legal aspects, Riparian land, Flood control, Damages, Backwater, Evaluation, Value, Property values, Operation and maintenance, Water levels, Flood damage, Flooding, Land tenure.
Identifiers: *Injunction, Trespass.

Upper riparian owners sought injunctive relief to prevent flooding by a dam constructed by the lower riparian owners. The trial court found evidence that the dam was causing the flooding. It therefore enjoined the defendants from closing the port holes or raising the existing height of the dam. The court further held it could not award damages since the plaintiffs offered no proof of valuation or the cost of restoration. The plaintiffs appealed for further relief to enjoin the defendants from maintaining the dam higher than the stream bed where the stream left the plaintiffs' property. Sustaining the factual findings in the record, the appellate court modified the judgment in providing that the plaintiffs could seek additional relief for further substantial injury at the foot of the judgment or could bring separate actions for any subsequent injury. The court found the defendants were continuing to commit a technical trespass. (Breeze-Fla)
W69-09400

CONTROL OF CERTAIN SALVAGE OPERATIONS.

S C Code Ann secs 54-321 thru 54-328 (Supp 1968).

Descriptors: *South Carolina, *Legislation, *Regulation, *State jurisdiction, Proprietary power, Low water mark, Ownership of beds, Navigable waters, Riparian rights, Salvage value.
Identifiers: *Shipwrecks, *Archaeology, *Artifacts.

Title to the bottoms of navigable waters within one marine league seaward from the Atlantic Seashore, measured from the mean low water mark, and title to all shipwrecks, vessels, and all things therein remaining unclaimed for more than ten years is declared to be in the state of South Carolina. The custodian of these shipwrecks, vessels and all things therein is the State Department of Archives and History which may issue a permit to conduct salvage operations for shipwrecks. Money derived from this source may be used by the Department. Penalties for conducting unauthorized salvage operations for shipwrecks are provided. (Moulder-Fla)
W69-09404

BATTJES BUILDERS V BOUMA (COUNTY DRAIN PROJECT).

167 NW 2d 123-126 (Ct App Mich 1969).

Descriptors: *Michigan, *Drainage, *Public health, *Administrative agencies, Judicial decisions, Assessments, Flood protection, Natural streams, Local governments, Construction, Taxes, Administrative decisions, Adjudication procedure.
Identifiers: Whiskey Creek drain, Drain Commission, Injunctions (Prohibitory).

Plaintiffs sought to enjoin defendant drain commission from constructing a county drain. Plaintiffs contended that the drain, in benefiting only one party, would not be conducive to the public health, welfare and convenience as required by the drain code. The court found that the drain would serve plaintiffs as well as others. This was held to be sufficient to satisfy the drain code requirement. Plaintiffs' second contention was that defendant commission should have established a new drain instead of improving an existing drain which was a natural watercourse. The court found that a natural watercourse was included in the statutes defining drains. Also, the court found that the legislature had intended the improvement of natural watercourses to be within the drain code. The court stated that the drain commission could contract with a private person for the construction of drain facilities part of the consideration for which would be the relief of assessments made upon the private person. (Gadd-Fla)
W69-09414

WATER SUPPLY; SANITATION.

Vt Stat Ann tit 18, sec 108 (1968).

Descriptors: *Vermont, *Water supply, *Drainage, *Cities, Administrative agencies, Local government, Sewage, Construction, Buildings, Legislation, Legal aspects.
Identifiers: Sanitation.

The commissioner of health, when requested or when he deems necessary, may advise municipal officers in regard to drainage, water supply and sewerage of towns and villages and in regard to the erection, construction, heating, ventilation and sanitary arrangements of buildings. (Shevin-Fla)
W69-09419

LAKE CALUMET HARBOR.

Ill Ann Stat ch 19, secs 113-118 (Smith-Hurd 1963).

Descriptors: *Illinois, *Harbors, *Construction, *Maintenance, Cities, Leases, Industries, Costs, Legislation, Legal aspects, Engineering structures, Navigation, City planning, Maintenance costs, Operation and maintenance, Utilities, Navigable waters, Administrative agencies.
Identifiers: Lake Calumet, Chicago.

Chicago may construct a harbor of specified minimum depth and area. The acceptance by the city of lands granted by this act obligates the city to maintain the harbor. The city may convey or lease any land granted by this act for industrial, manufacturing, or harbor purposes. The deed or lease must stipulate that the land shall be used within a certain time for the purpose authorized. The Department of Public Works and Buildings must approve all such sales and leases. If the Department takes no action on the application within thirty days of its filing, the sale or lease is deemed approved. Money from these sales and leases is credited to the Lake Calumet Harbor Fund forrbor maintenance and other related uses. (Breeze-Fla)
W69-09421

LEVEL OF LAKE MICHIGAN.

Ill Ann Stat ch 19, secs 119-120 (Smith-Hurd 1963).

Descriptors: *Illinois, *Great Lakes, *Water levels, *Regulation, Administrative agencies, Coordination, Lake Michigan, Water conveyance, Surveys, Cities, Planning, Construction, Projects, Legislation, Legal aspects, Lakes, Federal government, State governments, Administration, Project planning, Data collections, Contracts.

The Department of Public Works and Buildings shall regulate and maintain the levels of the Great Lakes and also suggest regulations for the diversion of water therefrom. It shall make all necessary surveys and enter into any agreements with cities and other agencies, both state and federal, in order to carry out these duties. (Breeze-Fla)
W69-09422

CHICAGO PARK DISTRICT AND CONSTRUCTION OF HARBOR FOR RECREATIONAL PURPOSES.
Ill Ann Stat ch 105, secs 333.23L to 333.23U (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Recreational facilities, *Harbors, *Parks, Marinas, Land use, Riparian rights, Excavation, Breakwaters, Docks, Piers, Legislation, Legal aspects, Recreation, Legislation, Financing, Land reclamation, Public lands, Beds.

The Chicaga Park District has the power to acquire, maintain and improve a harbor, marina, pier, or other similar structure to be used for recreation and public benefit at any location within the jurisdiction of the park district which borders on public waters. To carry out the purposes of this title, the Chicago Park District will have the same rights over its harbor as it does over its other property. The district may furnish mooring, docking and repair facilities. It may acquire any necessary additional property, reclaim submerged lands under public waters, and control the use and operation of the harbor. Any reclaimed lands shall become part of the public park. The park district

nay finance the construction of a harbor facility by ssuing revenue bonds to be paid with income lerived from the facility. (Kelly-Fla)
W69-09424

OPERATION AND MAINTENANCE OF HARBORS FOR RECREATIONAL PURPOSES.
ll Ann Stat ch 105, secs 11.1-1 thru 11.1-10 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Recreational facilities, *Marinas, *Harbors, Parks, Land use, Riparian ights, Excavation, Breakwaters, Docks, Piers, Legislation, Legal aspects, Recreation, Financing, Land reclamation, Public lands, Beds.

Any park district bordering upon public waters has he power to acquire, maintain and improve a harbor, marina, pier or other structure to be used for ecreation and public benefit anywhere within the park district jurisdiction. To carry out the purposes of this title, a park district will have the same rights over its harbor as it does over its other property. The district may: furnish mooring, docking and epair facilities; acquire necessary additional property; reclaim submerged lands under public waters; and control the use and operation of the harbor. Any reclaimed lands shall become part of he public park. The park district may finance the construction of a harbor facility by issuing revenue bonds to be paid with income derived from the facility. (Kelly-Fla)
W69-09426

SURFACE WATER PROTECTION DISTRICTS.
ll Ann Stat ch 42, secs 448 thru 471 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Surface waters, *Regulation, Legislation, Legal aspects, Eminent domain, Right-of-way, Administration, Water utilization, Financing, Taxation, Decision making, Local governments, Water control, Flood control, Damages, Bonding.
Identifiers: Surface water protection districts.

After a petition, hearing, and election a surface water protection district may be formed to prevent and control surface water damage, although under certain circumstances a district may be organized without an election. A similar procedure is followed to add new territory to the district. Procedure for appointment of a board of trustees as well as establishment of their powers and duties is set out in detail. The board has authority to adopt and enforce ordinances, acquire real and personal property required for its corporate purposes and may, if necessary, exercise the power of eminent domain over such property and may also acquire necessary rights of way over public property or property held for public use. The district has authority over water regulation of cities and towns under its jurisdiction. It issues bonds to finance its projects and pays the interest and costs thereof through direct annual taxes. Property may be detached from the district after a proper petition, public hearing, and court order. (Johnson-Fla)
W69-09428

SURFACE WATER PROTECTION DISTRICTS.
ll Ann Stat ch 42, secs 448 thru 451a (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Surface waters, *Administrative agencies, *Water control, Jurisdiction, Legislation, Legal aspects, Public health, Ditches, Dams, Channels, Sewers, Damages, Water utilization, Adjudication procedure, Surface drainage.
Identifiers: Surface water control.

In the interest of public health, safety and welfare surface water protection districts may be formed to use ditches, channels, sewers, dams and other necessary construction to protect against injury to lives and property due to damage by surface water. To be qualified to become a district the territory must be a contiguous area, not in more than two counties, so situated that establishment of facilities will conduce promotion and protection of public health and safety from damage due to surface water and so situated that the territory is not within the jurisdiction of another district. When fifty or more legal voters of a proposed district petition the circuit court for the establishment of a district such court shall hold a hearing in which residents of the proposed district may appear and be heard. Upon approval of the petition by said court, an election takes place which is supervised by the court and in which a majority of affirmative votes cast is necessary to establish a district. A petition by all the owners of land within a proposed district for an order incorporating a district may be made in lieu of the election procedure outlined previously. (Johnson-Fla)
W69-09429

SURFACE WATER PROTECTION DISTRICTS.

Ill Ann Stat ch 42, secs 452 thru 459 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Surface waters, *Administrative agencies, *Jurisdiction, Legal aspects, Water law, Administration, Adjudication procedure, Regulation, Decision making.

All courts must take judicial notice of the existence of surface water protection districts. Such districts constitute a body corporate which may sue or be sued. After a petition by one per cent of the legal voters in a proposed addition to a district and a public hearing before the circuit court, an election is held in which the new area is added to the existing district on the majority vote of those participating in the election. The appropriate county court appoints five trustees who compose the governing board for the district and whose terms are generally five years. Board members and employees of the board are prohibited from having financial interests in the activities, contracts, and work of the district, but are not prohibited from owning land which is taxed for purposes of the district. The court which made the original appointment fills subsequent vacancies on the board. The members of the board of trustees may be compensated up to $250 per annum and have the power to pass all necessary ordinances, rules and regulations for proper management and conduct of the district's business. (Johnson-Fla)
W69-09430

SURFACE WATER PROTECTION DISTRICTS.
Ill Ann Stat ch 42, secs 460 thru 464 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Surface waters, *Administration, *Regulation, Legislation, Legal aspects, Eminent domain, Right-of-way, Competing uses, Damages, Administrative agencies, Jurisdiction, Streams, Flow control, Flood control, Water control, Property values, Alteration of flow, Public lands.
Identifiers: Surface water damage control.

All ordinances of the district must be properly posted or published and proof thereof is required to be kept by the corporation's secretary. When surface water protection facilities are acquired from a city or village the district must reimburse such city for the reasonable value of said facilities. The board may adopt and enforce necessary ordinances, acquire real and personal property rights by exercise of eminent domain, if necessary, and also enter upon any public property or property held for public use when making improvements so long as the public use of such property is not unnecessarily or unreasonably disturbed. The board has power, and it is its duty and obligation to provide adequate protection from surface water damage for all persons or property within its jurisdiction and to prescribe necessary regulations for prevention and control of surface water damage. When the board proposes to change the flow or improve the course of any stream it must obtain permission for same from the Department of Public Works and Buildings. (Johnson-Fla)
W69-09431

SURFACE WATER PROTECTION DISTRICTS.

Ill Ann Stat ch 42, secs 465 thru 471 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Local governments, *Surface waters, *Taxation, Legislation, Financing, Legal aspects, Jurisdiction, Adjudication procedure, Tax rate, Costs, Operating costs, Administrative agencies, Administration, Bonding.
Identifiers: Surface water protection facilities.

When powers of a district conflict with those of a city or village such city or village shall cease to own, operate, or control surface water protection facilities located within the district's jurisdiction. The board may issue bonds to raise funds for necessary projects subsequent to approval in an election within the district, although districts organized without an election may issue bonds on approval of all landowners within the district. The board may assess taxes to pay indebtedness of the district and the interest thereon and, subject to certain limitations, may also finance their normal corporate activities through taxation. An election must be held to change the tax rate of the district. Before any bonded indebtedness has occurred a petition may be filed with the county court to have property detached from the district if the property is not qualified to belong to the district or if it would be more advantageous to become associated with another district. If, after a proper hearing, the county court finds for the petitioner, an order from said court removes such property from the district. (Johnson-Fla)
W69-09432

RE-LOCATING WATERCOURSES.

Ill Ann Stat ch 24, secs 11-87-1 thru 11-87-5 (Smith-Hurd 1962).

Descriptors: *Illinois, *Alteration of flow, *Streambeds, *Local governments, Streams, Ownership of beds, Navigable waters, Streamflow, Diversion, Channels, Canals, State governments, Highways, Condemnation, Legislation, Construction, Legal aspects, Cities, Artificial watercourses, Natural streams, Landfills.

City and village governments may alter or re-locate the channel, course, or bed of any natural or artificial watercourse within the corporate limits in order to establish, widen, or extend streets or sidewalks. Title to reclaimed land, within the corporate limits, which was part of the bed of the altered stream vests in the city or village. Title to the new stream bed vests in the state. The local government may fill in such portions of a non-navigable canal, slip, or branch of any natural or artificial stream as is necessary to construct streets and sidewalks. The power of the city or village government is limited by state law governing regulation of rivers, lakes, and streams within the state. Property may be condemned when needed to complete the improvements and is within one-half mile of the relocated stream. (Kelly-Fla)
W69-09435

HARBORS FOR RECREATIONAL USE.
Ill Ann Stat ch 24, secs 11-92-1 thru 11-92-6 (Smith-Hurd 1962).

Descriptors: *Illinois, *Harbors, *Recreation facilities, *Cities, Navigable waters, Legislation, Riparian rights, Condemnation, Regulation, Operation and maintenance, Financing, Beds under water, Docks, Shores, Taxes, Land reclamation.

Any city or village of less than 500,000 population which borders on any public waters has the power to acquire, construct, replace, improve, and operate a harbor for the recreational use and benefit of the public anywhere within the jurisdiction of the city, or in, over and upon public waters bordering thereon. The city or village has all the rights and powers over its harbor as it does over its other property. These powers include: (1) furnishing complete harbor facilities, (2) acquiring by gift, devise, purchase, or condemnation any property necessary or appropriate for the purposes of this section, (3) using and reclaiming submerged land under public waters, (4) locating and establishing docks, shores, and harbor lines, and (5) regulating and controlling harbor operation. The land acquired under this act shall be exempt from taxation. The city has the power to borror money by issuing bonds in anticipation of revenue from the harbor. (Heckerling-Fla)
W69-09436

WATERCOURSES, CANALS, WHARVES, AND LEVEES.
Ill Ann Stat ch 24, secs 11-104-1 thru 11-104-3 (Smith-Hurd 1962).

Descriptors: *Illinois, *Watercourses (Legal), *Local governments, *Construction, Repairing, Legislati on, Legal aspects, Navigable waters, Channels, Canals, Docks, Levees, Cities.

The corporate authorities of each municipality of the state may deepen, widen, dock, cover, or alter channels of watercourses. They may construct and repair canals and slips for the accommodation of commerce. In addition, they may construct and repair water-landing places, wharves, docks, and levees. (Kelly-Fla)
W69-09437

REGULATION AND RESTRICTION IN THE LOCATION AND USE OF STRUCTURES.
Ill Ann Stat ch 34, sec 3151 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Regulation, *Floodwat er, *Surface waters, Legislation, Damages, Hazards, Storm runoff, Structures, Industries, Runoff, Legal aspects, Overland flow.

Counties may regulate and restrict the location and use of buildings, structures, and land for trade or industry for the purpose of lessening or avoiding the hazards to persons and damages to property resulting from the accumulation or runoff of storm or flood waters. (Heckerling-Fla)
W69-09439

4B. Groundwater Management

THE AVAILABILITY OF GROUNDWATER FOR COOLING PURPOSES (DUTCH),
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
For primary bibliographic entry see Field 05B.
W69-09048

CHEMICAL AND BIOCHEMICAL ASPECTS OF DISPOSAL OF USED GROUNDWATER BY RECHARGING (DUTCH),
Drinkwaterleiding der Gemeente Rotterdam (Netherlands).
For primary bibliographic entry see Field 05D.
W69-09054

CONJUNCTIVE USE OF GROUND AND SURFACE WATERS,
Calif ornia State Dept. of Water Resources, Los Angeles.
James J. Doody.
J Amer Water Works Ass, Vol 61, No 8, p 395-397, Aug 1969. 3 p.

Descriptors: *Conjunctive use, *Model studies, *Mathematical models, *Groundwater basins, *California, Optimization, Economics, Computer models, Digital computers, Water management (Applied), Water resources development, Surface waters.
Identifiers: Groundwater basin models.

Partial or total application of the methods will provide much of the data necessary for making current management decisions as to the best way of meeting future water demands. Not only can a few arbitrarily selected operational plans be compared by its use, but the tools are also provided whereby an optimum plan can be derived by the local water agency. The economic impact of various legal and political constraints on the optimum plan can also be evaluated. Because this method is written in general terms and preserved in computer programs, it permits rapid updating and adjustment of operating criteria as conditions change, as more geologic and hydrologic information becomes available, and as experience is gained in actual operations. (Knapp-USGS)
W69-09136

HYDROGEOLOGICAL STUDIES FOR DRINKING WATER SUPPLY OF CRAIOVA CITY (ROMANIAN),
Gheorghe P. Constantinescu.
Hidrotehnica, Gosp Cipelor, Meteorol, Vol 13, No 3, p 123-141, Mar 1968. 19 p, 9 fig, 7 tab, 23 ref.

Descriptors: *Water resources development, *Hydrogeology, *Water supply, Geomorphology, Potable water, Aquifers, Springs, Quaternary period, Observation wells, Analytical techniques, Water properties, Watershed management, Rivers.
Identifiers: *Romania, Craiova water supply, Jiu River.

The geology and hydrogeological conditions of the Jiu River basin are described as they relate to the water needs of the rapidly growing industrial city of Craiova, Romania. A comprehensive study was made that included measurements of springs and rivers, estimating seepage and underflow, drilling and experimentally pumping of test wells, analyzing selected water samples, and mapping of geologic units. Sands and gravels in Quaternary and Pliocene formations contain the only available groundwater which, however, is generally insufficient and of such inferior quality that it will not meet the needs of the city and surrounding area. The needs total 1.77 cu m/sec. Alternatives were considered that led to the conclusion that a dual water source would be necessary: (1) utilizing the underflow of the Jiu River floodplain and (2) development of the Karstic springs in the Vilcan Mountains. Quality of the Izuarna-Coetenigroup of springs is among the best in Romania. Water from the two sources will furnish Craiova City until 1985. (Lang-USGS)
W69-09287

PLANNED UTILIZATION OF GROUNDWATER BASINS: STUDIES CONDUCTED IN SOUTHERN CALIFORNIA,
California Resources Agency. Dept. of Water Resources.
Robert Y. D. Chun, Ernest M. Weber, and Kiyoshi W. Mido.
Int Ass Sci Hydrol, Symp Haifa, p 426-434, March 1967. 9 p, 2 fig.

Descriptors: *Mathematical models, *Simulation analysis, *Groundwater basins, *Water distribution, *Comparative costs, Natural resources, Digital computers, Water resources development, Hydrologic data.

A non-linear mathematical model was utilized to simulate the dynamic behavior of a groundwater basin. The study was carried out for the purpose of developing physically feasible plans of basin operation to provide water to the consumer at the lowest cost with no deterioration of natural resources. Comprehensive geologic, hydrologic and operational-economic studies provided the data and a general purpose digital computer was used to test the model. The general procedures for setting up a model network and model parameters were given. An on-line digital plot technique, which was developed to provide rapid output to simplify model testing, was described. A verified model of the groundwater basin made it possible to achieve reliable results for evaluation of both the physical feasibility and comparative costs of a wide range of management plans. A general purpose method of determining the most economical coordination of surface and underground water supplies and facilities was the final result of the study. (Thiuri-Cornell)
W69-09372

SYSTEMS ENGINEERING AND AQUIFER MANAGEMENT,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 06A.
W69-09373

CONSTRUCTION OF WELLS AND WATERWORKS.

Ill Ann Stat ch 24, sec 11-125-1 (Smith-Hurd 1962).

Descriptors: *Illinois, *Cities, *Water supply, *Water wells, Water conservation, Water management (Applied), Artesian wells, Water sources, Drilling, Pumping, Well regulations, Regulation, Pumps, Waterworks, Construction costs, Cisterns, Costs, Water loss, Water pollution, Pollution abatement, Legislation, Water pollution control, Legal aspects.

The corporate authorities in any city or village may: (1) provide for the water supply by boring artesian wells or by digging, constructing or regulating wells, pumps, cisterns, reservoirs, or waterworks; (2) borrow money therefor; (3) authorize persons to bore, dig, construct and maintain the same for a period not exceeding 30 years; (4) prevent the unnecessary waste of water; (5) prevent the pollution of water; and (6) prevent injuries to such wells, pumps, cisterns, reservoirs or waterworks. (Shevin-Fla)
W69-09438

4C. Effects on Water of Man's Non-Water Activities

STIGALL V SHARKEY COUNTY (SUIT TO DETERMINE JURISDICTION OVER HIGHWAY WHICH HAD CAUSED FLOODING).
42 So 2d 116-120 (Miss 1949).

Descriptors: *Mississippi, *Local government, *Road construction, *Jurisdiction, Highways, Drainage systems, Overflow, Federal jurisdiction, State jurisdiction, Paving, Graded, Culverts, Drainage, Ditches, Surface waters, Flood damage, Obstruction to flow, Drainage engineering, Legal aspects, Judicial decisions.

Plaintiff brought this suit against defendant county to recover damages to his crops caused by overflow of water resulting from improper construction of a road. Plaintiff charged defendant with the negligent and wrongful acts of filling up an existing drainage canal and the construction of a road bed upon that fill. Plaintiff alleged that defendant placed culverts under this road which were inadequate to carry the normal flow of water. The issue raised before the court was whether the county had jurisdiction of the road. If it did have jurisdiction, it would be responsible for the alleged damages caused. This question arose since the state highway department provided a survey of the road and other aid in its construction, while the federal government pro-

vided plans and man power through the WPA. The court held though, in that all work was done with county permission, the county had jurisdiction of the road and would be liable for all crop damage resulting from negligent construction of this road. (Logan-Fla)
W69-09070

THE FLORENCE FLOODS,
Vermont Univ., Burlington. Dept. of Botany.
For primary bibliographic entry see Field 02E.
W69-09132

LOUISVILLE WATER CO INC V BOSLER (TORT LIABILITY FOR WATER DAMAGES FROM BROKEN CONDUITS).

433 SW 2d 105-109 (Ky 1968).

Descriptors: *Kentucky, *Conduits, *Rupturing, *Damages, Compensation, Judicial decisions, Water supply, Pipelines, Sewers, Soil structure, Soil density, Soil-water relationships, Cities.
Identifiers: *Tort liability, *Foundations, Actual notice, Implied notice.

Plaintiffs sought damages for water damage to their merchandise allegedly caused by defendant water company's negligence in allowing one of its water mains to break. Seven other breaks had occurred in defendant's pipes at the downtown intersection in question. Defendant's superintendent testified that the company was aware of the terrible condition of sewers below the pipes, which might affect the foundation under the pipes. On the evidence, the jury awarded plaintiffs $7,834.69 damages. On appeal by defendant, the court of appeals of Kentucky held plaintiff did not have the burden of proving a defect in the particular section of pipe which broke. The court felt the evidence sufficient to go to the jury where previous breaks and knowledge of conditions might reasonably have put defendant on notice of possible future breaks if no remedial precautions were taken. (Harris-Fla)
W69-09407

LIABILITIES OF TOWNS FOR DAMAGES CAUSED BY INADEQUATE BRIDGES OR CULVERTS.

Vt Stat Ann tit 19, secs 1371-1396 (1968).

Descriptors: *Vermont, *Bridge failure, *Damages, *Construction, Culverts, Legal aspects, Legislation, Bridges, Bridge construction, Repairing, Local governments, Boundaries (Property).

Persons sustaining injury or property damage by reason of the insufficiency or want of repair of a bridge or culvert may recover damages in a tort action against the town responsible for its upkeep. If two or more towns are jointly responsible, recovery may be had against both. Total damages may not exceed $3,000 or the amount of insurance carried, whichever is greater. If two or more towns are liable and one is outside the state, the town or towns within the state are proportionately liable. Recovery may not be had if the injured party was acting in violation of the law or exceeding the weight limitations for the bridge or culvert. The statute sets forth the required procedure for initiating a claim. (Kelly-Fla)
W69-09418

4D. Watershed Protection

WATERSHED CONSERVATION DISTRICTS.
SC Code Ann, secs 63-171 thru 63-191 (Supp 1968).

Descriptors: *South Carolina, *Watersheds (Basins), *Water conservation, *Administrative agencies, Project planning, Water resources development, Water utilization, Water districts, Legislation, Soil conservation, Soil erosion, Flood protection, Disposal, Land tenure, Soil management, State governments, Financing, Programs.
Identifiers: Water conservation districts.

Watershed conservation districts may be established as herein provided within one or more soil and water conservation districts for the purpose of developing and executing plans and programs relating to any phase of the control and prevention of soil erosion or flood prevention, the conservation, development and utilization of soil and water resources and the disposal of water. This authority is applicable to, but not limited to, the planning and carrying out of works of improvement for the above purposes. Certain procedures shall be followed in setting up the district. The procedures include petitioning by landowners to set up the district. Supervisors shall be appointed and a referendum held on the establishment of the district. The governing body shall consist of five directors elected as provided herein. The district shall be a governmental subdivision of the state and shall exercise public powers as provided herein. The district may issue bonds and levy taxes for payment thereof. Procedures are set up for collecting taxes, annexing lands, and discontinuing the district. (Heckerling-Fla)
W69-09102

REVEGETATION PROCEDURES FOR IMPROVEMENT OF THE SAN SIMON WATERSHEDS,
Arizona Univ., Tucson. Dept. of Watershed Management.
Gilbert L. Jordan.
Internat'l Conf. on Arid Lands in a Changing World, Arizona Univ., Tucson, June 3-13, 1969. 3 tab, 8 p.

Descriptors: *Watershed management, *Revegetation, Arizona, Arid lands, Arid climates, Yield, Sheetflow surface runoff, Valleys, Drought resistance, Alteration of flow, Brush control, Erosion control, Habitat improvement, Plant groupings, Deserts, Soil moisture, Deep tillage, Range management, Vegetation regrowth, Grasses, Ranges.
Identifiers: San Simon Valley (Ariz), Lehmann Lovegrass.

The San Simon Valley of southeastern Arizona is a frail watershed subject to excessive erosion and channel development. More than half of the annual precipitation of 9.5 in. occurs as torrential thunderstorms during the summer. Present cover consists of various communities of Sonoran and Chihuahuan desert shrubs. Shrubs frequently outcompete grasses for the limited soil moisture, exposing areas of bare soil. The first requirement for revegetation was adequate shrub removal; several methods were evaluated: Chained or bull dozer-cleared areas of creosotebush attained 75% of original growth in 4 yr. (sand dune mesquite 75% in 2 yr.). June was more effective than March for chaining. Adequate brush control could be had only by root plowing or disk plowing. Attention was also given to concurrent seedbed preparation and modification, type of seedbed, time of seeding and method of seeding. With Lehmann lovegrass, broadcasting has been as effective a means of planting as drilling. March seeding was much more successful than June in 1968, while in other years there was little difference. Disk plowing was constantly better than root plowing and both were better than chained and pitted seedbeds. Of several other species of Eragrostis studied, the most promising was Boer lovegrass E. curvula var. conferta. Substantial increases in yield were obtained from pitting of plowed seedbeds. Forage yields of 800-1500 lbs/acre were achieved on the better sites, along with runoff prevention. (Sherbrooke-Ariz)
W69-09205

CHEREVKOVSKOY WATER-MEADOWS OF THE NORTH DVINA VALLEY. I. NATURAL CONDITIONS (RUSSIAN),
Leningrad State Univ. (USSR).
L. N. Alekseyenko, and N. A. Frantskevich.
Vestnik, Leningr Univ, No 24, Geol-Geogr, Issue 4, p 135-146, 1968. 12 p, 3 fig, 28 ref.

Descriptors: *Flood plains, *Rivers, Topography, Erosion, Geomorphology, Microclimatology, Hydrologic properties, Vegetation, Animal populations, River basins, Water sources, Climates, Ice, Seasonal, Water level fluctuations, Groundwater, Geology, Structural geology, Lakes.
Identifiers: *USSR, Northern Dvina water-meadows.

The present topographical, geological and floral conditions of the Cherevkovskoy water-meadows are described and the hydrological regime of the Northern Dvina and its effect on the geomorphology and soil-forming processes of the river's water-meadows are analyzed. The variety of ecological conditions and the effect of man-made activities are also discussed. (Gabriel-USGS)
W69-09292

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

RAPID PHOSPHATE DETERMINATION BY FLUORIMETRY,
Missouri Univ., Columbia. Dept. of Chemistry; and Oak Ridge National Lab., Tenn. Div. of Analytical Chemistry.
John C. Guyon, and Wilbur D. Shults.
J Amer Water Works Ass, Vol 61, No 8, p 403-404, Aug 1969. 2 p, 3 fig, 3 ref.

Descriptors: *Analytical techniques, Chemical analysis, *Phosphates, *Fluorometry, Pollutant identification, Water chemistry, Water quality.
Identifiers: Phosphate analysis.

To measure phosphate contamination, two similar fluorometric procedures are offered, one for low concentrations and one for high. The methods proposed were evaluated by adding known amounts of phosphate to volumetric flasks and carrying out the analysis as described in the recommended procedures. An average relative error of 1-5% was observed for the one system, and 2% for the other. These suggested methods provide survey techniques for phosphate determinations over a wide range of concentrations. The methods are manipulatively simple, and should be readily adaptable to field survey or to conventional or automated laboratory situations. (Knapp-USGS)
W69-09137

FIGHTING WATER POLLUTION.
Performed Line Products Co. of Cleveland, Ohio.

Under Sea Technol, Vol 10, No 5, p 46-47, May 1969.

Descriptors: *Water pollution, *Buoys, *Lake Erie, Temperature, Waves (Water), Wind velocity, Turbidity, Turbidity currents, Bottom sediments, Conductivity, Light intensity.
Identifiers: Lake Erie buoy system, Water pollution monitoring.

A buoy system developed by the Preformed Line Products Co. of Cleveland, Ohio was tested by mooring this sytem in Lake Erie five miles north of Cleveland. The system is being designed to measure acidity of the water, temperature variation and gradient, wave height and frequency, wind speed, wind direction, turbidity, conductivity, bottom sediments, and penetration of light at various depths and times. (Gabriel-USGS)
W69-09147

METHODOLOGY OF HYDROCHEMICAL INVESTIGATIONS (RUSSIAN).
Akademiya Nauk SSSR, Leningrad. Gidrokhimicheskii Institut.
For primary bibliographic entry see Field 02K.
W69-09152

DISTRIBUTION OF METHANE AND CARBON MONOXIDE BETWEEN THE ATMOSPHERE AND NATURAL WATERS,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 02K.
W69-09230

DETERMINATION OF PHOSPHATE IN NATURAL WATERS BY ACTIVATION ANALYSIS OF TUNGSTOPHOSPHORIC ACID,
Bureau of Commercial Fisheries, Ann Arbor, Mich. Biological Lab.; and Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W69-09232

A HORIZONTAL WATER SAMPLER FOR INVESTIGATION OF STRATIFIED WATERS,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 02H.
W69-09257

SENSORS FOR THE ANALYSIS AND CONTROL OF BIOLOGICAL PROCESSES,
Metropolitan Sanitary District of Greater Chicago, Ill. Research and Development Lab.
David R. Zenz, Timothy J. McAloon, and Clark L. Weddle.
Proc Amer Chem Soc Symp on Water, Air, and Waste Chem, Apr 13-18, 1969, Minneapolis, Minn, 1969. 41 p, 12 fig, 2 tab, 22 ref, 1 append.

Descriptors: *Sewage treatment, *Monitoring, *Sampling, *Measurement, *Instrumentation, Research and development, Mathematical models, Control systems, Activated sludge, Anaerobic digestion, Biological treatment.
Identifiers: Sewage treatment monitoring.

Available and experimental instruments for monitoring activated sludge and anaerobic sewage treatment processes are surveyed. The main difficulty encountered with most instruments is fouling of the sensor process lines and other equipment in contact with the samples. This fouling is primarily caused by grease and solid accumulations which result in excessive maintenance and recalibration. These problems in many instances can be minimized by homogenization of the sample stream before analysis and making provisions for automatic flushing of the instrument. Instruments to measure pH, temperature, dissolved oxygen and sludge level have been satisfactorily applied on a continuous basis. The Chicago Metropolitan Sanitary District is presently employing temperature, dissolved oxygen and sludge level detection instruments to automatically control some aspects of biological treatment. In addition, treatment plants can be operated with the aid of advanced computer techniques in conjunction with improved mathematical models that accurately describe the behavior of these processes. This type of advanced system could also have instant readout of the operating and analytical parameters and a memory bank capable of storing historical data for process investigation. (Knapp-USGS)
W69-09265

ON BICARBONATE DETERMINATION IN NATURAL WATER (ROMANIAN),
For primary bibliographic entry see Field 02K.
W69-09289

PROBLEMS OF THE CHEMISTRY OF NATURAL WATERS OF THE SOVIET UNION AND METHODS SUITABLE FOR THEIR ANALYSIS (RUSSIAN).
Akademiya Nauk SSSR, Leningrad. Gidrokhimicheskii Institut.
For primary bibliographic entry see Field 02K.
W69-09291

A RAPID METHOD FOR ESTIMATING RADIUM AND RADON IN WATER,
Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section.
D. N. Kelkar, and P. V. Joshi.
Health Physics, Vol 17, p 253-257, 1969. 5 fig, 2 tab, 4 ref.

Descriptors: *Radium radioisotopes, *Estimating, Temperature, Hydrogen ion concentration, Thermal springs, Radioactivit y, Groundwater, Lead radioisotopes, Sampling.
Identifiers: *Radon, Zinc sulfide scintillation powder, Barium, India, Bombay, Concentrations, Alpha activity, Bismuth, Polonium, Photomultiplier scaler, Thickness.

A rapid method for estimating radium and radon in water samples with activity levels more than 1-2 picocuries per liter, is described. Radium and daughter products of radon are precipitated with more than 95% efficiency in the presence of zinc sulfide (silver) scintillation powder giving a composite scintillator-sample combination. Apart from being rapid and inexpensive, the method is suitable for field use as it requires little apparatus and does not involve laborious chemical analysis. It is based on the co-precipitation of radium, and lead, bismuth and polonium with barium (as carrier) in the presence of zinc sulfide (silver) powder. Effects of temperature, hydrogen ion concentration, and amount of zinc sulfide (silver) were studied and conditions for optimum yield were determined experimentally. Excessive thickness of the sample affected counting. The overall eff iciency of the method, including geometry, is 68%; other conventional methods (excluding the emanation method) is seldom more than 45-48%. This method, though less sensitive than the more conventional methods, is quick, inexpensive and gives fairly good accuracy. Results of radium and radon levels in thermal springs measured in the field using this method, are tabulated. (Jones-Wis)
W69-09336

5B. Sources of Pollution

COOLING POND DESIGN IN THE SOUTHWEST,
Ebasco Services, Inc., New York.
T. J. Cotter, and A. W. Lotz.
Journal of the Power Division, Proceedings of the ASCE, Vol 87, No PO2, p 85-103, July 1961. 17 p, 13 fig, 1 tab.

Descriptors: *Thermal pollution, *Water conservation, *Engineering structures, *Cooling towers, Water resources, Non-consumptive use, Topography, Hydrologic data, Intake gates, Water discharge, Wells.
Identifiers: *Southwest, *Cholla Plant, *Four Corners Plant, Cooling pond design, 'Hot pond' concept.

The use of cooling ponds as a source of circulating water for central steam-electric stations is (in 1961) steadily increasing in the United States. The pond design for greatest effi ciency in heat dissipation must consider pond depth, intake depth, separation of intake and discharge, and make-up water supply. Although formulae and heat balances have been developed, judgment factors based on experience with varying physical characteristics under different climatological conditions are more critical in the design. These considerations are discussed in detail with reference to ponds at the Cholla and the Four Corners Plants in New Mexico. (Sherman-Vanderbilt)
W69-09031

PREDICTION OF TEMPERATURE IN RIVERS AND RESERVOIRS,
California Univ., Berkeley. Civil Engineering Dept.
Jerome M. Raphael.
Journal of the Power Division, Proceedings of the ASCE, Vol 88, No PO2, p 157-181, July 1962. 25 p, 8 fig, 6 tab.

Descriptors: *Water pollution effects, *Temperature control, *Climatological data, *Energy-Budget, Thermal pollution, Heat balance, Temperature distribution, Heat transfer, Solar radiation, Thermocline, Evaporation.
Identifiers: *Temperature prediction, Short wave radiation, Back radiation, Lake Hefner.

A procedure is presented for predicting the temperature of various water bodies from weather records, inflow and outflow characteristics, and the surface area and volume of the body of water. The method can be applied to shallow lakes, flowing streams, and detention reservoirs, in which the thermocline is absent and the water is so stirred by wind or current that temperatures are uniform. The heat-flow problem is reviewed and the essential equations are derived. An evaluation is made of the effect of atmospheric conditions such as air temperature, relative humidity, cloud cover, wind speed, and barometric pressure on short-wave insolation and reflectance, long-wave radiation from atmosphere and water, evaporation, conduction, and advection. Sources of climatological data are examined. A numerical procedure is described by which all these effects are combined for a short time increment and a complete heat balance obtained yielding the temperature change of the body of water during the interval. An example is given of the use of the method, which is easily adaptable to machine computation. The method should find application in the comparison of temperature of streams with and without detention reservoirs and in the dissipation of heat from industrial sources in streams and lakes. (Sherman-Vanderbilt)
W69-09032

THERMAL POLLUTION OF WATER SYSTEMS,
Rutgers - The State Univ., New Brunswick, N.J.
Burton Davidson, and Robert W. Bradshaw.
Environmental Science and Technology, Vol 1, No 8, p 618-630, Aug 1967. 13 p, 8 fig, 14 ref.

Descriptors: *Thermal pollution, *Simulation analysis, *Dissolved oxygen, *Biochemical oxygen demand, *Water resources development, *Optimization, Mathematical models, Temperature control, Analog models, Hydrologic data, Water pollution sources.
Identifiers: Enthalpy balance, Temperature index.

The temperature pollution index to be established must satisfy both law enforcement agencies and water users. Literature on thermal pollution is reviewed and related t o a mathematical simulation model of BOD and DO content. The DO factor is used to derive an optimal temperature in a polluted stream through a series of pollution-purification balance equations. These analyses have been restricted to slowly-moving, medium-sized streams, under summer conditions with idealized plug flow velocity. The optimization problems have three elements: continuous, deterministic performance equations (BOD-DO equation) and initial or boundary conditions; a piece wise continuous decision vector function and constraints (stream temperature, 0 deg C to 60 deg C; an objective function (maximization of stream DO). Temperature profiles are presented in the paper. (Sherman-Vanderbilt).
W69-09039

THE EFFECT OF TEMPERATURE ON THE DEOXYGENATION OF A POLLUTED ESTUARY,
Public Health Service, Philadelphia, Pa. Delaware Estuary Comprehensive Study.
For primary bibliographic entry see Field 05C.
W69-09044

THE AVAILABILITY OF GROUNDWATER FOR COOLING PURPOSES (DUTCH),
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
J. C. van Dam.
De Ingenieur, Algemeen Gedeelte 51, Jrg 80, p A743-A749, Dec 20, 1968. 7 p, 1 fig, 5 tab, 6 ref.

Descriptors: *Thermal pollution, *Applied water management, *Groundwater, *Water resources development, *Water discharge, *Water utilization, Natural recharge, Sludge disposal, Groundwater movement.
Identifiers: Netherlands.

The paper deals with conditions in the Netherlands. After a review of the occurrence of fresh, saline and brackish groundwater, information is given on the natural recharge and the safe yield of the fresh groundwater. The future water requirements for population and industry are far in excess of the safe yield of the fresh groundwater. Therefore, in general, fresh groundwater should not be withdrawn for cooling purposes exclusively, unless it is returned into the underground after use. Abstraction of saline and brackish groundwater generally does not meet with hydrological difficulties, however disposal of this water in fresh surfacewater is unacceptable. THEREFORE AFTER USE IT SHOULD EITHER BE DISCHARGED INTO THE SEA, BY PIPELINE, OR BE RETUR NED INTO THE UNDERGROUND. Finally some considerations are given on the increase of the groundwater temperatures in case warmed-up water is returned into the underground. Higher temperatures stand in the way of other abstractions for cooling. The final groundwater temperatures are reached after several years only. (Sherman-Vanderbilt)
W69-09048

THE RAPID THERMAL DIFFUSION OF STEAM STATION COOLING WATER DISCHARGE INTO RESERVOIRS,
Duke Power Co., Charlotte, N.C. Environmental Research.
J. Ben Stephenson.
Proceedings - Sixteenth Southern Water Resources and Pollution Control Conference, p 98-108, 1967. 11 p, 11 fig.

Descriptors: *Thermal pollution, *Water pollution effects, *Water chemistry, *Water treatment, *Temperature control, *Cooling water, Electric power plants, Thermal stratification, Dissolved oxygen, Water resources development, Limnology, Heat flow.
Identifiers: Thermal stability, Thermal behavior, Marshall Steam Station, Thermal diffusion.

The effect of temperature on other aquatic environmental factors is investigated, the dissolved oxygen content in particular, and related to water resources research and development (Marshall Steam Plant). Data from continuous testing (successive stations in a canal) of thermally stratified and thermally stable conditions of the reservoir is given in figures which relate temperature effects to dissolved oxygen content. One benefit found was that normally stagnant water from the bottom of the reservoir becomes exposed to the atmosphere and absorbed more oxygen. The lake observations of the discharging process indicate that water quality and other ecological factors are not impaired by the cooling waters. Generally, the temperature effects are limited because the discharged heat is rapidly diffused in the lake. Improved fishing conditions is one of the actual benefits which is cited. (Sherman-Vanderbilt)
W69-09050

RELATION OF PHOSPHATES TO EUTROPHICATION,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 05C.
W69-09135

LINDANE ADSORPTION BY LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soils.
Erik G. Lotse, Donald A. Graetz, Gordon Chesters, Gerhard B. Lee, and Leo W. Newland.
Environ Sci and Technol, Vol 2, No 5, p 353-357, May 1968. 5 p, 4 fig, 3 tab, 12 ref. OWRR Proj No B-008 Wis.

Descriptors: *Pesticide residues, *Sediments, *Lakes, *Adsorption, Path of pollutants, Clays, Silts, Chlorinated hydrocarbon pesticides, Water pollution sources, Pesticide kinetics.
Identifiers: *Lindane.

Lindane adsorption was determined on eight intact lake sediments using a radio-chemical technique. Lindane adsorption was shown to be affected by sediment suspension concentration, organic matter content, lindane concentration, clay content, and lindane-to-sediment ratio and to fit Freundlich's equation. As the l indane molecule is neutral and not subject to ionization, van der Waals forces and hydrogen bonding were considered the most feasible adsorption mechanisms. (Knapp-USGS)
W69-09167

CHEMICAL CONTAMINANTS FOUND IN SURFACE AND SUBSURFACE WATER AS RELATED TO SOIL AND CLIMATIC CONDITIONS.
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W69-09228

CHLORINATED INSECTICIDES IN RUNOFF WATER AS AFFECTED BY CROP ROTATION,
Maine Univ., Orono.
For primary bibliographic entry see Field 05G.
W69-09229

SOME GUIDELINES FOR REMOTE SENSING IN HYDROLOGY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W69-09241

THE EFFECT OF CATION EXCHANGE CAPACITY ON THE RETENTION OF DIQUAT AND PARAQUAT BY THREE-LAYER TYPE CLAY MINERALS: 1. ADSORPTION AND RELEASE,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
S. B. Weed, and J. B. Webber.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 379-382, May-Jun 1969. 4 p, 4 fig, 2 tab, 11 ref.

Descriptors: *Adsorption, *Herbicides, *Clay minerals, Soil chemical properties, Organic compounds, Montmorillonite, Magnesium, Potassium, Calcium, Ion exchange, Diquat, Paraquat, Path of pollutants.
Identifiers: Vermiculite.

Diquat and paraquat were equilibrated for thirty minutes with suspensions of three-layer clay minerals varying in CEC from about 1 to 1.6 meq/g. Maximum adsorption of the divalent organic cations, expressed as % of CEC, decreased from 100% for montmorilloni te (CEC= 1.03 meq/g) to 13% for a K -depleted muscovite (CEC= 1.63 meq/g). The exchangeable inorganic cation initially present markedly affected adsorption of diquat and paraquat by vermiculite but had much less effect on adsorption by montmorillonite. The order of adsorption was Na -vermiculite is greater than Ca -vermiculite is greater than or equal to Mg -vermiculite. Less than 15% of the adsorbed diquat or paraquat was released from montmorillonite by a single equilibration with approximately five symmetry of 0.005N chloride salt solutions of Al, Ca, Mg, or K. Similar treatment of vermiculite released up to 70% of the adsorbed organic cation, the order of release being from largest to smallest, Al, Ca, Al, for paraquat. Three successive treatments of vermiculite released up to 89% of the diquat or paraquat. (Knapp-USGS)
W69-09249

WARM-WATER IRRIGATION: AN ANSWER TO THERMAL POLLUTION,
SCIENCE, Washington, D.C.
Luther J. Carter.
Science, Vol 165, No 3892, p 478-480, Aug 1, 1969.

Descriptors: *Thermal pollution, *Nuclear power plants, *Waste-water disposal, Irrigation water, Public utilities, Nuclear wastes, Water utilization.
Identifiers: *Oregon, *Willamette Valley, Heated soil.

Two utility-financed projects for the agricultural use of heated waste-water are operating in Oregon. The warm-water discharge enhances plant growth and protects fruit trees from frost on a 170-acre tract (Willamette Valley) where plans are being made to experiment with an underground warm-water pipeline. A simulation has begun and been successful in the growth of corn on a 2-acre plot (Oregon State University). The utility investment in the farm was $475,000. A $2.6 million project has been drafted by the AEC but is not yet funded. Warm-water irrigation plans are appropriate in the Northwest because: (1) There are many acres of irrigable land; (2) There are many valuable fisheries in the rivers and restriction on river water use; (3) Tower and lake construction is expensive and unsightly compared to agricultural proposals. The findings are encouraging although limited and inconclusive. Professors at the University of Oregon warn that warm-water irrigation does not use the constant supply of effluent water, that it could be a health hazard, and presents research problems best handled by a university. (Sherman-Vanderbilt)
W69-09301

TEMPERATURE ANALYSIS OF A STREAM,
M. R. Collings.
Geological Survey Research, p 174-179, 1969. 5 fig, 2 tab, 6 ref.

Descriptors: *Temperature, *Streams, Meteorological effects, Water quality, Fourier analysis, Aquatic environment.
Identifiers: Chehalis River, Spot Water-temperature data, Hatcheries, Monthly maximum temperatures.

Temperatures of a stream were fitted and defined by a harmonic analysis of the probable occurrence, at the 95-percent level, of maximum and minimum monthly temperatures and of median temperatures throughout the year. The 0.5-probability curve of maximum temperatures was found to have equivalent values of amplitude and phase angle to that of a curve fitting 9 years of monthly maximum temperatures. Investigations also were made to determine the acceptability of using spot-temperatures throughout the year. A comparison, by regression analysis, of the mean monthly temperatures, from the thermograph record, with the synt hetically determined median monthly temperatures, from the spot measurements, showed a standard error of 1.6 deg C. Another comparison, between the average harmonic curve from 4 years of spot measurements and the median curve from the maximum and minimum monthly temperatures, showed a standard error of 0.9 deg C. (Ross-Vanderbilt)
W69-09305

DIFFUSION OF COOLING WATER DISCHARGE FROM MARSHALL STEAM STATION INTO LAKE NORMAN,
Duke Power Co., Charlotte, N.C.
R. Fred Gray, and J. Ben Stephenson.
ASCE National Meeting on Environmental Engineering, Power Division, Chattanooga, Tennessee, p 1-21, May 13-17, 1968. 12 fig, 1 tab.

Descriptors: *Cooling water, *Thermal pollution, *Thermal stratification, *Environmental effects, *Synoptic analysis, Meteorological data, Reservoir, Water discharge, Isotherms.
Identifiers: *Marshall Steam Station, *Lake Norman, Skimmer wall.

This article reports data and conclusions of field research on heat dissipation patterns at the Marshall Steam Station on Lake Norman. If temperature data and meteorological factors are known, then the cooling water diffusion can be monitored. The field site is described for which two units of 350 mw each operate. Special features in the dissipation process are a submerged skimmer weir and an inverted skimmer wall. Temperature profiles (several are shown) from the synoptic survey are representative of different seasons and meteorological conditions and show that distinct advantages result from the location on a large reservoir where bottom water can be used for condenser cooling. During the colder months, the heated water rises to the surface where it is cooled by air and wind, while in summer months, the use of cold bottom water for cooling results in discharge temperatures close to lake-surface water. Only a small part of the lakes cooling capacity is needed. A comprehensive three year study of biological conditions is planned. (Sherman-Vanderbilt)
W69-09307

MOVEMENT OF FALL-APPLIED NITROGEN IN SANDY SOIL,
Forest Research Lab., Maple (Ontario).
H. H. Krause, and W. Batsch.
Can J Soil Sci, Vol 48, p 363-365, Oct 1968. 1 fig, 8 ref.

Descriptors: *Nitrogen, *Leaching, Nitrates, Nitrification, Eutrophication, Cycling nutrients, Soils, Water pollution sources.
Identifiers: *Fall-applied fertilizer-nitrogen, *Sandy soil, Groundwater pollution.

A lysimeter experiment on a sandy soil indicated significant nitrification and leaching of added ammonium fertilizer occurring from September 20 to November 30. About 88% of the added fertilizer-nitrogen (112 kilograms/hectare of nitrogen as ammonium nitrate) was lost. Soil temperatures during the experiment were far below optimum for nitrification, and during the last half of the experiment, the soil froze repeatedly to depth of 5 centimeters. The results obtained indicated that fall applied fertilizer-nitrogen would be lost to the succeeding crop. (Keeney-Wis)
W69-09338

5C. Effects of Pollution

THERMAL REQUIREMENTS OF FISH - THREE DECADES OF STUDY, 1940-1970,
Fisheries Research Board, Nanaimo (British Columbia). Biological Station.
J. R. Brett.
Transactions of the Second Seminar on Biological Problems in Water Pollution, Robert A. Taft Sanitary Eng Center, p 110-117, 1959. 8 p, 5 fig, 33 ref.

Descriptors: *Temperature control, Acclimatization, Metabolism, Biology, Water supply, Aquatic environment, Thermal pollution.
Identifiers: Homeotherms, Environmental factors, Lipid structure.

Three decades of research (1940 to 1970) on temperature relations in fish, and cold-blooded animals generally, are discussed. Speculation on the trends in the next decade are made from a survey of current literature. Temperature acts in a variety of ways. It may kill, reduce activity, interact with other environmental factors, confine reproduction, and be a directing agent where a gradient exists. Differences between species in maximum temperature tolerance can be as great as 17 deg C (31 deg F), and, in overall tolerance, a difference factor of 2.7 times can separate the most tolerant from the least tolerant. Despite ability to withstand low temperatures, slow rates of acclimation appear to result in greater mortalities from cold in nature. Temperature controls the activities of fish by regulating rates of metabolism (resting and active). The numbing effects of low temperature restricting performance, or the equally restricting effects of high temperature demanding excessive body maintenance are of serious consequence for maintaining continuity of a species. Research on this aspect and the information made available is required if adequate thermal relations are to be prescribed for fish: In order to prescribe thermal requirements, limits to the 'safe' reduction of activity imposed by temperature are set forth as a basis for discussion. (Sherman-Vanderbilt)
W69-09030

MANAGING CLIMATIC RESOURCES,
Rand C orp., Santa Monica, Calif.
For primary bibliographic entry see Field 02B.
W69-09033

SWIMMING PERFORMANCE OF SOCKEYE SALMON (ONCORHYNCHUS NERKA) IN RELATION TO FATIGUE TIME AND TEMPERATURE,
Fisheries Research Board, Nanaimo (British Columbia). Biological Station.
J. R. Brett.
Journal of Fisheries Research Board of Canada, Vol 24, No 8, p 1731-1741, Aug, 1967. 11 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Sockeye salmon, *Thermal pollution, Fresh-water fish, Metabolism, Temperature, Acclimatization, Aquatic environment.
Identifiers: *Swimming performance of fish, Fixed velocity effects, Temperature effects, Lethal temperatures, Fatigue testing.

Further studies on the swimming performance of fingerling sockeye salmon at fixed velocities have been conducted in relation to fatigue time. The method of probit analysis, commonly used in dealing with bioassay data, was found to be suitable for determining times to 50% fatigue and in providing a measure of variance despite the presence of some erratic behavior. For sockeye acclimated to 15 deg C (mean length= 13.6 cm) the velocity at which 50% fatigued was 54.4 cm/sec or 4.0 lengths/sec (L/sec). The 5% and 95% fatigue velocities were 3.1 and 4.8 L/sec, respectively. Larger fish required longer exposure times for determining maximum sustained speeds, extending from approximately 120 min for fingerlings to 500 min for adults. Using the method of increasing velocity steps the effect of temperatures from 5 to 27.5 C was examined. When acclimated to 15 C fingerling sockeye exhibited only a 4% reduction in swimming speed at 10 and 20 C. Temperatures above the lethal level caused a rapid decline in swimming ability approaching the extinction point at 27.5 C. Recommendations for standard procedures in the study of swimming speeds are made. (Ross-Vanderbilt)
W69-09034

THE EFFECTS OF TEMPERATURE AND WATER HARDNESS UPON THE TOXICITY OF NAPHTHENIC ACIDS TO THE COMMON BLUEGILL SUNFISH, LEPOMIS MACROCHIRUS RAF., AND THE POND SNAIL, PHYSA HETEROSTROPHA SAY,
Academy of Natural Sciences of Philadelphia, Pa.
John Cairns, Jr., and Arthur Scheier.
Notulae Naturae of the Academy of Natural Sciences of Philadelphia, No 353, p 1-12, May 15, 1962. 8 tab, 9 ref.

Descriptors: *Aquatic environment, *Temperature, *Hardness, *Sunfishes, Thermal pollution, Toxicity, Acclimatization, Snail.
Identifiers: Bluegill sunfish, Pond snail, Naphtenic acid, Oxygenation.

Literature dealing with the toxicity of naphthenic acids is briefly discussed. For fish, the concentration of naphthenic acids which resulted in 50% survival in 96 hours was 5.79 p.p.m. in soft water at 18 deg C, and 5.60 p.p.m. in soft water at 30 deg C, 7.15 p.p.m. in hard water at 18 deg C, and 7.10 p.p.m. in soft water at 30 deg C; 12.6 p.p.m. in hard water at 20 deg C, and 12.2 p.p.m. in hard water at 30 deg C. (Sherman-Vanderbilt)
W69-09035

RESEARCH ON TEMPERATURE EFFECTS ON FISHES,
Federal Water Pollution Control Administration, Duluth, Minn. Nat ional Water Quality Lab.
Donald I. Mount.
Paper presented at the Eighth Annual Environmental and Water Resources Engineering Conference, Vanderbilt Univ, p 1-14, June 5-6, 1969. 14 p.

Descriptors: *Thermal pollution, *Temperature control, *Environmental effects, *Water quality control, Aquatic environment, Regional analysis, Thermal stratification, Commercial fish, Sport fish, Food chai ns.
Identifiers: *National Water Quality Laboratory, Yellow perch, White suckers, Northern pike, Brook trout.

Thermal pollution literature must be critically summarized and experimental objectives must be selected before research will advance. The current interest in thermal pollution results from publicized concern and the easiness of measuring and controlling temperatures but disregards problems such as thermal stratification, nonspontaneity of temperatures, or climatic effects. Although water standards have been recommended, optimum rather than maximum zone temperatures should be used to develop more curves of annual temperature regimes. Modification of the winter chill-period is the primary suggestion, and input balance is seen as an outmoded substitute for water treatment. Six objectives for the study reported are: A determination of which species among thirty from the study list require a chill-period during the winter months to imitate reproduction; studies to determine the critical periods in the life cycle of the desirable species and the temperatures required during these critical periods; a determination of the temperatures providing optimum growth for individual species; temperature requirements for food organisms of the species that are known to be important or essential; an evaluation of the rate of temperature change that is acceptable for various species; verification of laboratory-derived results in a semi-natural situation where all elements of the ecosystem must function together to produce a harvestable fish crop. The final measure of temperature effect will be the pounds-per-acre of fish produced. (Sherman-Vanderbilt)
W69-09036

THE RESISTANCE AND ACCLIMATIZATION OF MARINE FISHES TO TEMPERATURE CHANGES. I. EXPERIMENTS WITH GIRELLA NIGRICANS (AYRES),
Scripps Institution of Oceanography, La Jolla, Calif.
Peter Doudoroff.
Biology Bulletin, Vol 83, No 2, p 219-244, 1942. 26 p, 5 fig, 4 tab, 29 ref.

Descriptors: *Thermal pollution, *Heat resistance, *Cold resistance, Acclimatization, Ecology, Marine fish, Variability, Fluctuation, Biology.
Identifiers: *Girella, Heat-coma, Chill-coma, Survival criterion, Time-temperature curve.

The resistance of young Girella nigricans (Ayres) to low and high temperatures and the changes of tolerance produced by acclimatization are examined. The fish were killed by moderately low temperatures, the lower limits of temperature tolerance being no more extreme, in comparison with normal environmental temperatures, than the corresponding upper limits. The relationship between the duration of exposure to the test tem-

peratures and the upper or lower 'median tolerance limits' is representable by smooth time-temperature curves of tolerance. Acclimatization to different temperatures has a pronounced influence on the form of the respective time-temperature curves of tolerance. Experiments on the rate of acclimatization correlate the conclusion, based on earlier observations, that heat-resistance in fish is gained rapidly after a rise of temperature and lost slowly after cooling. Acclimatization to cold is relatively slow, and cold-resistance is lost no more slowly than it is acquired. After a given change in environmental temperatures, about 50 percent of the total resulting change in cold-tolerance occurs in two days, and complete acclimatization is achieved within about twenty days. Injury by chilling is no less important as a possible limiting factor in the distribution of marine fishes than heat injury. Figures and tables show the collection and correlation of tolerance limits and acclimatization duration data. (Sherman-Vanderbilt)
W69-09037

THE RESISTANCE AND ACCLIMATIZATION OF MARINE FISHES TO TEMPERATU RE CHANGES. II. EXPERIMENTS WITH FUNDULUS AND ATHERINOPS,
Scripps Institution of Oceanography, La Jolla, Calif.
Peter Doudoroff.
Biology Bulletin, Vol 88, No 2, p 194-206, 1945. 13 p, 2 fig, 5 tab, 22 ref.

Descriptors: *Cold resistance, *Thermal pollution, *Heat resistance, *Acclimatization, Temperature control, Respiration, Dehydration, Salinity, Marine fish.
Identifiers: *Fundulus, *Atherinops, Heat-coma, Chill coma, Girella, Duration, Osmoregulative failure.

The resistance of the hardy mari ne fish Fundulus parvipinnis and of the delicate Atherinops affinis to low and high temperatures is examined in relation to temperatures of previous acclimatization and to temperature conditions in the natural habitats of the fishes. The relationships between the time (duration) of exposure to test temperatures and the average (median) limits of temperature tolerance indicate the value of prolonged tests in the study of resistance to cold and heat. Marked suscepti bility of marine fishes to chilling (i.e., injury at non-freezing low temperatures) and the influence of acclimati zation upon temperature tolerance are confirmed. The death of Fundulus at slowly lethal low temperatures, but not at rapidly lethal temperatures, is preceded in the normal medium (seawater) by evident dehydration of the tissues and is delayed by dilution of the medium. Osmoregulative failure is indicated as one of the causes of slow death at low temperatures in seawater, but not of rapid death at more extreme low temperatures, which may be caused partly by respiratory disturbances. (Sherman-Vanderbilt)
W69-09038

PREFERRED TEMPERATURE OF RAINBOW TROUT (SALMO GAIRDNERI RICHARDSON) AND ITS UNUSUAL RELATIONSHIP TO ACCLIMATION TEMPERATURE,
Toronto Univ. (Ontario). Lab. for Experimental Limnology.
E. T. Garside, and J. S. Tait.
Canadian Journal of Zoology, Vol 36, p 563-567, 1958. 1 fig, 1 tab, 5 ref.

Descriptors: *Rainbow trout, *Thermal pollution, *Aquatic environment, Temperature gradient, Photography.
Identifiers: Preferred temperature, Acclimation temperature.

The purpose of this study was to determine the selected or preferred temperature of the rainbow trout, Salmo gairdneri Richardson, at various acclimation temperatures. The preferred temperature of fish generally has been found to be influenced by the temperature at which they are acclimated. The fish were reared at the laboratory from eggs supplied by the Provincial Fish Hatchery at Normandale, Ontario, in May 1955. The modal preferred temperatures of rainbow trout acclimated to 5 deg C, 10 deg C, 15 deg C and 20 deg C were determined photographically to be 16 deg C, 15 deg C, 13 deg C and 11 deg C, respectively. The final preferendum was 13 deg C. The phenomenon of decreasing preferred temperature with increasing acclimation temperature has not been reported for any other species of fish. (Ross-Vanderbilt)
W69-09040

ACCLIMATION TO TEMPERATURE IN THE MARINE COPEPOD, CALANUS FINMARCHICUS (GUNNER.),
Dalhouse Univ., Halifax (Nova Scotia). Inst. of Oceanography.
K. Halcrow.
Limnology and Oceanography, Vol VIII, No 1, p 1-8, Jan 1963. 8 p, 6 fig, 2 tab, 19 ref.

Descriptors: *Acclimatization, *Marine animals, *Copepods.
Identifiers: *Respiratory rate, Oxygen uptake, C. finmarchicus, Oxygen uptake overshoot.

C. finmarchicus has cosmopolitan distribution and is found in waters at -2 deg to 22 deg C. Test organisms were harvested with plankton tows (No. 000 mesh nylon net) from the coastal waters of Nova Scotia. Respiratory rate was determined with a modified oxygen electrode technique. Three acclimation rates were employed, 4 deg, 10 deg and 20 deg C. Copepods collected in March and April showed the highest respiratory rate at 10 deg, while those collected in August had the highest rate at 20 deg. In each case the lowest rate was at 4 deg. Overshoot of oxygen uptake was demonstrated when copepods were exposed to a sudden temperature change, i.e., oxygen consumption increased greatly in the first 2 hr and thereafter fell to a constant level in 4 hr. (Malaney-Vanderbilt)
W69-09043

THE EFFECT OF TEMPERATURE ON THE DEOXYGENATION OF A POLLUTED ESTUARY,
Public Health Service, Philadelphia, Pa. Delaware Estuary Comprehensive Study.
David H. Stoltenberg, and Matthew J. Sobel.
Journal of the Water Pollution Control Federation, Vol 37, No 12, p 1705-1715, Dec 1965. 11 p, 2 fig, 3 tab, 12 ref.

Descriptors: *Thermal pollution, *Water pollution effects, *Dissolved oxygen, *Biochemical oxygen demand, Sanitary engineering, Natural streams, Estuary sampling, Incubation, Organic loading, Bicarbonates, Phosphates, Chlorides.
Identifiers: *Delaware estuary, *Decay coefficient, Analysis of covariance, Temperature coefficient, Van't Hoff-Arrhenius formula, Sodium theosulfate.

A systems analysis technique has been presented for describing the space and time variations of dissolved oxygen (DO) in a body of water. The response of the water body system to the action of a 'forcing function' can be measured in terms of t he specific parameter, DO, which is affected by the biochemical oxygen demand (BOD). Because of a lack of sufficient data for K (deoxygenation constant) for the Delaware Estuary comprehensive study, the following work was done to determine its values in the estuary. The decay coefficient was related empirically to stream temperatures after the effect on the coefficient of organic matter concentration and other factors was tested. There are two sections: (1) a study of the effects of collection temperature, sampling location, tidal stage, and organic loading on K for various samples incubated at the same temperature; and (2) determinations of K as a function of incubation temperature. (Sherman-Vanderbilt)
W69-09044

SOME EXPERIMENTS UPON TEMPERATURE ACCLIMATIZATION AND RESPIRATORY METABOLISM IN FISHES,
Scripps Institution of Oceanography, La Jolla, Calif.
F. B. Sumner, and P. Doudoroff.
The Biological Bulletin, Vol 74, No 3, p 403-429, June 1968. 27 p, 7 fig, 9 tab, 19 ref.

Descriptors: *Respiration, *Metabolism, *Thermal pollution, *Aquatic environment, Potassium cyanide.
Identifiers: *Temperature acclimatization, *Gillichthys mirabilis, Cyanide, Boiled seawater, Lethal heat, Lethal cold, Urethane, Respiratory movements, Fish metabolism, Fundulus parvipinnis.

Fishes (Gillichthys mirabilis) having different temperature histories were subjected to KCN, to boiled seawater, and to temperatures high or low enough to be lethal. Urethane, an anesthetic, was used in a limited number of experiments. The time of death (or of anesthetization) was recorded for each of the fishes (nearly 3,000). Counts of respiration were made in numerous cases. Death in both KCN and i n boiled water was speedy in proportion to the temperature, the reciprocals of the times of death forming an approximate logarithmic series when plotted against temperature. The temperatures used were 10 deg, 15 deg, 20 deg, 25 deg, and 30 deg C. In the case of KCN, a low correlation was found to exist between the duration of previous acclimatization to high or low temperatures and the degree of resistance to KCN at those temperatures. When fishes which had been acclimatized to high (30 deg) and low (10 deg) temperatures were tested in KCN, boiled water or urethane at 20 deg, there was a consistent reversal in the resistance of the respective lots. Death in de-oxygenated seawater was more than 60 percent slower, at the same temperatures, than in KCN solution. Even though the size of the fish appeared to have little or no influence upon its resistance to lethal heat or to cyanide poisoning, it was found that smaller fishes had a more rapid respiratory rhythm, and succumbed more rapidly in boiled water than larger ones. (Ross-Vanderbilt)
W69-09045

BIOCHEMICAL EFFECTS OF COOLING-WATER DISCHARGE INTO PUBLIC WATERS (DUTCH),
Instituut voor Gezondheidstechniek TNO, The Hague (Netherlands).
J. K. Baars.
De Ingenieur, Gezondheids techniek, p G85-G88, Dec 20, 1968. 4 p, 3 fig, 4 tab, 1 ref.

Descriptors: *Thermal pollution, *Waste-water treatment, *Water pollution effects, Biochemical oxygen demand, Chemical properties, Cooling water, Reaeration.

'Thermal pollution' of a body of water, as being caused by the disposal of cooling water of higher temperature, has various aspects which - under certain conditions - can be detrimental to aquatic life as such. The form of the resulting oxygen sag curve is reviewed, with data from several sources shown. From the biochemical point of view the paper gives a condensed survey of the different factors active in this respect, and the eventual precautionary or remedial measures to be envisaged. (Sherman-Vanderbilt)
W69-09049

THE RAPID THERMAL DIFFUSION OF STEAM STATION COOLING WATER DISCHARGE INTO RESERVOIRS,
Duke Power Co., Charlotte, N.C. Environmental Research.
For primary bibliographic entry see Field 05B.
W69-09050

THE EFFECTS OF HIGH TEMPERATURES ON ROACH (RUTILUS RUTILUS) I. THE EFFECTS OF CONSTANT HIGH TEMPERATURES,
King's Coll., London (England). Dept. of Zoology.

Anthony W. Cocking.
The Journal of Experimental Biology, Vol 36, No 1, p 203-216, Mar 1959. 14 p, 4 tab, 4 fig, 36 ref.

Descriptors: *Thermal pollution, *Heat resistance, *Acclimatization, Temperature control, Fish physiology, Heated water.
Identifiers: *Rutilus rutilus, *Thermal relations, Fry, Median temperature tolerance, High lethal limit, Asphyxial concentration.

In a laboratory investigation a fairly hardy fish, Rutilus Rutilus (Roach), was tested for high lethal temperature limits and median thermal tolerance levels. These results and observations of behavior patterns were then compared to those of a fish with different eurythermal and stenothermal habits. The stages and symptoms of the fish after transferral to a constant higher temperature are described. The five stages with some variations are: period of no response, initial distress, recovery, final distress, loss of control, death or complete recovery. Data results included the following: (1) The temperature at which 50% of a sample of roach (Rutilus rutilus) die within a week cannot be raised above 33.5 deg C by raising the acclimatization temperature. (2) The mean asphyxial concentration of oxygen at 30 and 32 deg C is approximately 0.8 mg./1. (3) Median survival time at any lethal temperature increases with increase in acclimatization temperature; survival time for any acclimatization temperature decreases as test temperatures increase. (4) The behavior, on transfer to higher temperatures, depends on the acclimatization temperature and the size of the jump in temperature and can be divided into five characteristic stages. (Sherman-Vanderbilt)
W69-09051

THE EFFECTS OF HIGH TEMPERATURES ON ROACH (RUTILUS RUTILUS); II. THE EFFECTS OF TEMPERATURE INCREASING AT A KNOWN CONSTANT RATE,
King's Coll., London (England). Dept. of Zoology.
Anthony W. Cocking.
Journal of Experimental Biology, Vol 36, No 1, p 217-226, Mar 1959. 10 p, 5 fig, 1 tab, 12 ref.

Descriptors: *Aquatic environment, *Thermal pollution, *Fish behavior, Temperature, Acclimatization.
Identifiers: *Lethal temperatures, Roach (Rutilus Rutilus), Oxygen concentration effects, Ammonia effects, High temperature effects, Carbon dioxide effects.

Temperature effects on aquatic life are investigated in an environment where the temperature is rising at a constant rate. The following results were obtained: (1) When roach were acclimatized to 20 deg C and then subjected to five constant rates of temperature rise, the range of death temperatures depended on the interaction between the opportunity for acclimatization and the exposure to lethal temperatures. (2) At 1/20 deg C an hour rise in temperature, roach acclimatized fully, died over the longest temperature range (30.3-35/8 deg C) had the highest mean death temperature (32. deg C) and died over a disproportionate length of time (up to 88 hr.) when compared with other rates. The death temperature range at 1/10 deg C an hour was 30.8-32.0 deg C (mean 31.4 deg C) and at 8/10 deg C an hour was 31.5 to 32.9 deg C (mean 32.9 deg C). (3) Roach cannot acclimatize fully at rates faster than 1/20 deg C an hour though some acclimatization takes place at a rate of 8/10 deg C an hour. (4) Roach excrete more ammonia as the temperature rises but the increase depends on the rate of temperature rise and is delayed for up to 240 hr. at 1/20 deg C an hour. (5) The behavior showed characteristic changes. (6) Roach died from the posterior end forwards; the heart was beating and the gall bladder abnormal when the body was opened. (Ross-Vanderbilt)
W69-09052

FUTURE ASPECTS OF COOLING-WATER DISCHARGE BY ELECTRICAL POWER PLANTS (DUTCH),
Directie Waterhuishouding en Waterbeweging van de Rijkswaterstaat, Delft (Netherlands).
P. J. Wemelsfelder.
De Ingeni eur, Bouw-en Waterbouwkunde 15, p B179-B198, Dec 20, 1968. 10 p, 17 fig, 7 tab.

Descriptors: *Thermal pollution, *Water utilization, *Water resources development, *Cooling-water, *Electric power plants, Waste-water disposal, Water supply, Thermal properties.
Identifiers: *Netherlands, Cooling-water discharge, Natural water resources.

For the first electrical power plants in the Netherlands the availability of water for their cooling purposes did not give rise to any problem. The continuous increase of such plants, in numbers and capacities has introduced, however, the necessity of situating those new and bi gger plants in the vicinity of major bodies of water, in order to safeguard the cooling-water requirements and at the same time to keep the effects of discharge within acceptable limits. The still growing demand for electrical energy makes it inevitable to investigate the entire matter more profoundly. In the present paper a quantitative analytical treatment is given of the practical use of available natural water-bodies in the Netherlands in view of the future needs as to cooling purposes. (Sherman-Vanderbilt)
W69-09053

THERMAL ACCLIMATION AND TEMPERATURE SELECTION IN ATLANTIC SALMON, SALMO SALAR, AND RAINBOW TROUT, S. GAIRDNERI,
Carleton Univ., Ottawa (Ontario). Dept. of Biology.
M. Yaqub Javaid, and John M. Anderson.
Journal of Fisheries Research Board of Canada, Vol 24, No 7, p 1507-1513, July 1967. 7 p, 2 fig, 1 tab, 10 ref.

Descriptors: *Thermal pollution, *Aquatic environment, *Temperature gradient, Atlantic salmon, Rainbow trout.
Identifiers: *Thermal acclimation, Temperature selection.

The selected temperature for Atlantic salmon and rainbow trout, as determined in a horizontal gradient, increases with acclimation temperature over the acclimation range 5 to 20 deg C for salmon and 10 to 20 deg C for trout. The final preferendum for salmon is about 17 deg C. The results for rainbow trout suggest that the type of gradient used, i.e., vertical or horizontal, has a marked influence on the experimentally determined relation between acclimation temperature and selected temperature. The final preferendum for rainbow trout was not reached, evidently it is higher than 20 deg C. Five different groups of fish were tested for each species at each acclimation temperature. (Ross-Vanderbilt)
W69-09056

RELATIONSHIP OF TEMPERATURE TO TOTAL ANNUAL GROWTH IN ADULT SMALLMOUTH BASS,
Department of Lands and Forests, Picton (Ontario). Glenora Fisheries Station.
Daniel W. Coble.
Journal of Fisheries Research Board of Canada, Vol 24, No 1, p 87-99, Jan 1967. 13 p, 1 fig, 4 tab, 23 ref.

Descriptors: *Water temperature, *Growth rates, *Smallmouth bass, *Fish physiology, Thermal pollution, Aquatic environment.
Identifiers: South Bay, Lake Huron.

The purpose of this study was to find out if total annual growth of smallmouth bass, Micropterus dolomieui Lacepede, is related to temperature and, if so, what variation around the relationship exists Two sets of information were used: original data o two populations of smallmouth bass in Ontario fo which rather detailed information on growth an temperature were obtained, and published data o growth of smallmouth bass in various wate throughout the North American range. Total yearl growth of smallmouth bass of ages 3-5 in Sout Bay, Lake Huron, and in several other widely scat tered populations was related to mean surfac water temperature for the period July through Sep tember, more growth being associated with warme waters. The difference in the manifestation of growth-temperature relationship appears to b real, rather than a result of differences in data o treatments of them, and indicates, therefore, tha other factors may influence total annual growth a much as, or more than, temperature. (Ross-Van derbilt)
W69-09057

TEMPERATURE TOLERANCE OF SOME AN TARCTIC FISHES,
Stanford Univ., Calif. Dept. of Biological Sciences.
G. N. Somero, and A. L. De Vries.
Science, Vol 156, p 256-258, April 14, 1967. 3 p, fig, 1 tab, 14 ref.

Descriptors: *Fish, Aquatic environment, Mortali ty, Metabolism, Water pollution effects, Cold wate fish, Lethal limit.
Identifiers: *Temperature tolerance, Lethal tem peratures, Antarctic fishes.

Three species of Antarctic fishes which live in con stantly near-freezing waters have a markedly low upper-lethal temperature at 6 deg C; this was the lowest upper-lethal temperature reported for an organism. The fishes survived supercooling to -2. deg C. Data on brain metabolism is vitro supporte by the hypothesis that the central nervous syste was a primary site of thermal injury. It was also sug gested that thermal death may have resulted fro subtle biophysical changes in the cellular lipids perhaps the membrane lipids, rather than fro direct thermal destruction of enzyme function (Ross-Vanderbilt)
W69-09058

RELATION OF PHOSPHATES TO EUTROPHI CATION,
North Carolina Univ., Chapel Hill. Dept. of En vironmental Sciences and Engineering.
Charles M. Weiss.
J Amer Water Works Ass, Vol 61, No 8, p 387-391 Aug 1969. 5 p, 2 fig, 4 tab, 22 ref.

Descriptors: *Eutrophication, *Lakes *Phosphates, Nutrients, Algae, Water pollution ef fects, Water pollution sources, Aquatic productivi ty, Limnology, Plankton, Primary productivity Trophic level.
Identifiers: Lake Tahoe.

The relationship of phosphates in water to primary production is examined, and the phosphorus cycle in natural lake biological systems is outlined Although higher than normal macronutrient level will generally produce an increase in levels o productivity or shift of trophic status, the specific interrelationships of each nutrient factor are ex ceedingly complex and remain unclear. The biolog ical storage of phosphorus by algae in excess of im mediate growth requirement, its secretion as solu ble organic phosphorus, and its reuse would appea to be a significant factor in satisfying nutrien levels, particularly for those species with low phosphorus requirements. Increases in trophic status are generally associated with invasion o blue-green algae, which have capability fo nitrogen fixation with resulting enhancement o nitrogen levels and acceleration of the rate o eutrophication. The rate of trophic response o each lake or reservoir to changes in macronutrien levels involves not only nutrient change, but also the total chemical and physical characteristics o the particular basin. The chemical nature of the

particular phosphorus species, its association with colloidal or particulate materials and the specific associated phytoplankton all contribute to the rate of utilization of the phosphate pool and thus the rate of eutrophication. (Knapp-USGS)
W69-09135

CHEMICAL AND MINERALOGICAL CHARACTERISTICS OF EUTROPHIC LAKE SEDIMENTS,
Connecticut Agricultural Experiment Station, New Haven.
C. R. Frink.
Soil Sci Soc Amer Proc, Vol 33, No 3, p 369-372, May-June 1969. 4 p, 3 fig, 2 tab, 21 ref.

Descriptors: *Sediments, *Eutrophication, *Water chemistry, Clay minerals, Nutrients, Nitrogen compounds, Phosphorus compounds, Weathering, Limnology, Lake soils, Mud.
Identifiers: Sediment chemistry, Nutrient sources, Nutrient storage.

Detailed chemical and mineralogical analyses of the sediments of a eutrophic lake revealed that most of the characteristics usually associated with high productivity increased considerably with increasing depth of water. Thus, the center of the lake is enriched in clay, organic matter, N, and P when compared with the sediments around the edge or the soils in the watershed. Most of the changes in physical characteristics are attributed to size sorting during transport and deposition within the lake. A number of chemical changes also accur as sediment is transported from the acid watershed to the neutral lake environment. Chief among these chemical weathering processes are the dechloritization of Al-interlayered vermiculite and its subsequent conversion to illite, as well as a shift of stored phosphates from Al-P and Fe-P to Ca-P. Thus, these observations help to describe the process of eutrophication and serve as a basis for further analysis of the nutrient-supplying ability of lake sediments. (Knapp-USGS)
W69-09144

DEGRADATION OF GAMMA - BHC IN SIMULATED LAKE IMPOUNDMENTS AS AFFECTED BY AERATION,
Wisconsin Univ., Madison. Dept. of Soils.
L. W. Newland, G. Chesters, and G. B. Lee.
Jour Water Poll Control Fed, Vol 41, part 2, p 174-188, May 1969. 25 p, 1 tab, 7 fig, 28 ref. OWRR Proj B-016-WIS.

Descriptors: *Biodegradation, *Insecticides.
Identifiers: GAMMA-BHC, Isomerization, *Aeration effects, *Simulated lake impoundment.

The degradation of gamma-BHC in simulated aerobic and anaerobic lake impoundments was determined and anaerobic degradation was much more rapid than aerobic degradation. In the aerobic simulated lake impoundment, degradation of 15 percent of the added gamma-BHC occurred in 2,100 hr and the isomer alpha-BHC was formed as the degradation product. In the anaerobic impoundment some 90 percent of the added gamma-BHC was degraded in the 2,100-hr incubation period to the isomers alpha- and delta-BHC. Because of the profound effect of oxygen on degradation rates and the apparent 'lag phase' of the reaction, it is concluded that the isomerization of gamma-BHC occurs by a biological mechanism. The thermodynamic stability of benzene hexachloride isomers is in the order gamma-BHC< alpha-BHC< delta-BHC< beta-BHC. However, volatilization of gamma-BHC and alpha-BHC from the impoundments prevented the formation of the more stable isomers, namely, delta- and beta-BHC although in the later stages of degradation in the anaerobic impoundment some delta-BHC was formed. The isomerization leads to detoxification of the insecticide, e.g., the acute oral lethal dosage (LD50) for rats is 125 mg/kg body weight for gamma-BHC, 500 mg/kg for alpha-BHC and 6,000 mg/kg for delta-BHC.
W69-09227

STEAM-ELECTRIC POWER AND THERMAL POLLUTION,
Sports Fishing Inst.
R. H. Stroud.
SFI Bulletin, No 201, p 1-3, Jan-Feb, 1969. 3 fig.

Descriptors: *Thermal pollution, *Electric power plants, *Cooling towers, *Cooling ponds, *Wastewater treatment, Administration, Public utilities, Freshwater runoff.
Identifiers: *Closed circuit cooling.

Predicted and actual data displaying the danger to overheated streams of increasing steam electric station industries by heat discharge is reported as well as the available cooling facilities and a generalized cost for the process (estimate 3% of production cost). These systems are rated from least to most effective by the author as: once-through cooling (negligible effect), evaporative cooling towers (reduction of differential between heated discharge and intake temperatures to 1/2), cooling pond, closed circuit cooling, combinations. Thermal pollution is seen as within means of control with technology and administrative policy to be utilized when there is a public demand. Recent power company projects are described and those plants with immediate need for controlling measures are named. It is noted that a recent listing of conventional steam plants (of 500 mw or larger) 7 used cooling towers, 5 cooling ponds, 21 once-through cooling, and 14 did not report. Of 32 completed or planned nuclear facilities, 7 use cooling towers and the rest once-through cooling. Some details are presented for a few plants deemed adequate. (Sherman-Vanderbilt)
W69-09304

WATER USE AND THERMAL POLLUTION,
EG and G, Inc., Las Vegas, Nev.; and Reynolds Electrical and Engineering Co., Inc.
Frank C. Di Luzio.
Power Engineering, Vol 85, p 44-46, June 1968. 1 tab, 1 fig.

Descriptors: *Thermal pollution, *Water pollution effects, *Waste water disposal, *Water Quality Act, *Water pollution sources, Power plants, Waste water treatment, Water quality, Aquatic environment.
Identifiers: *National Power Survey, Nuclear breeder reactors.

Thermal pollution sources, effects, control and standards enforcements are discussed. Although thermal change is viewed as natural, the heat capacity of aquatic environments in the United States is often exceeded, and the increasing power production is an index of increasing thermal pollution. With higher water temperatures, toxic effects are greater, the water is less capable of assimilating other wastes, and the dissolved oxygen supply is less. One of the criteria of the Water Quality Act is water temperature, while recognizing natural climatic changes. In the state regulations, the varied social water interests are considered. Technological solutions to waste heat disposal are listed as follows: (1) methods to minimize the effect of the waste heat on the aquatic environment; (2) means to reduce waste heat produced in thermal generation plants; (3) uses for waste heat; (4) methods to cool the present amount of waste heat; (5) new non-polluting methods of power generation. (Sherman-Vanderbilt)
W69-09306

DIFFUSION OF COOLING WATER DISCHARGE FROM MARSHALL STEAM STATION INTO LAKE NORMAN,
Duke Power Co., Charlotte, N.C.
For primary bibliographic entry see Field 05B.
W69-09307

EUTROPHICATION OF THE ST. LAWRENCE GREAT LAKES,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
Alfred M. Beeton.
Limnology and Oceanography, Vol 10, No 2, p 240-254, 1965. 4 fig, 3 tab, 52 ref.

Descriptors: *Great Lakes, *Eutrophication, *Hypolimnion, *Lake morphometry, *Lake morphology, *Dissolved oxygen, *Dissolved solids, *Nutrients, Oligotrophy, Phosphorus, Nitrogen, Biota, Sewage disposal, Domestic wastes.
Identifiers: *Mesotrophy, Transparency, Specific conduction.

Lakes Huron, Michigan, and Superior are classified as oligotrophic lakes on the basis of their biological, chemical, and physical characteristics. Lake Ontario, although rich in nutrients, is morphometrically oligotrophic or mesotrophic because of its large area of deep water. Lake Erie, the most productive of the lakes and the shallowest, is eutrophic. Several changes commonly associated with eutrophication in small lakes have been observed in the Great Lakes. These changes apparently reflect accelerated eutrophication in the Great Lakes due to man's activity. Chemical data compiled from a number of sources, dating as early as 1854, indicate a progressive increase in the concentrations of various major ions and total dissolved solids in all of the lakes except Lake Superior. The plankton has changed somewhat in Lake Michigan and the plankton, benthos, and fish populations of Lake Erie are greatly different today from those of the past. An extensive area of hypolimnetic water of Lake Erie has developed low dissolved oxygen concentrations in late summer within recent years. The information is detailed in tables and graphs. (Sherman-Vanderbilt)
W69-09315

THERMAL POLLUTION OF WATER COURSES,
Potomac Electric Power Co., Washington, D.C.
L. W. Cadwallader.
Proceedings of the Nineteenth Industrial Waste Conference, Purdue Univ, Lafayette, Indiana, p 9-11, May 5-7, 1964.

Descriptors: *Thermal pollution, *Environmental effects, *Water pollution effects, *Industrial wastes, *Water quality control, Freshwater, Nonconsumptive water use, Model studies, Biology.
Identifiers: *Biodynamic cycle.

A general account is given of the thermal pollution problem and research needs. Most highly recommended are field studies, viewing thermal pollution in the context of natural variations in temperatures. Laboratory information about temperature effects has been generalized but without substantiating data about natural conditions. There is little knowledge of the effects of heated discharges on the receiving water, especially on the competitive biodynamic cycle. World War II is seen as the beginning of concern about water resources (freshwater) because of new industrial expansion. The establishment of water standards is challenging because unqualified restriction of thermal discharges would severely limit the nation's electricity generating capacity. A hydraulic model study has been made to determine the intake-discharge arrangement for the best overall effect for Chalk Point on the Patuxent River. Final design details were based on temperature elevation in the river as predicted by the model. The Potomac Electric Power Company intends to monitor the site after operation begins, thus providing valuable field information. (Sherman-Vanderbilt)
W69-09317

THE EFFECT OF THE ADDITION OF HEAT FROM A POWERPLANT ON THE THERMAL STRUCTURE AND EVAPORATION OF LAKE COLORADO CITY, TEXAS, (STUDIES OF EVAPORATION),
Geological Survey, Washington, D.C.
Earl G. Harbeck, Jr., G. E. Koberg, and G. H. Hughes.
Geological Survey Professional Paper 272-B, U.S. Government Printing Office, Washington, 1959.

Descriptors: *Evaporation, *Thermal pollution, *Energy budget, Heat, Reservoir evaporation, Cooling water, Powerplants.
Identifiers: Powerplant, Thermal structure.

Lake Colorado City, a reservoir in north-central Texas, is used as a source of cooling water for a thermal-electric powerplant. Evaporation from the lake was determined by the energy-budget method for the period July, 1954 to October, 1955. Analyses indicated that if no heat had been added by the powerplant, the water-surface temperature would have been only 0.8 deg C lower than that observed. The temperature rise was almost directly proportional to the heat input. The increase in evaporation from Lake Colorado City, when expressed as a volume, was directly proportional to the amount of heat added and was practically independent of reservoir contents. The entire lake is being effectively utilized in disposing of heat. A comparison between average lake temperatures and plant intake water temperatures indicated that water was withdrawn from all levels of the lake above the pump intakes. (Ross-Vanderbilt)
W69-09320

OBSERVATIONS ON THE INFLUENCE OF THE NEW JOHNSONVILLE STEAM PLANT ON FISH AND PLANKTON POPULATIONS,
Tennessee Game and Fish Commission.
William Dryer, and Norman G. Benson.
Tenth Annual Conference Southeastern Association of Game and Fish Commissioners, Biological Abstract, Vol 10, p 85-91, 1957. 7 p, 3 tab, 1 fig, 1 ref.

Descriptors: *Thermal pollution, *Fish migration, *Fish food organisms, *Freshwater lake, Sport fish.
Identifiers: *Power plant effluent.

This study covered the period October 1955 to August 1956. Water for condenser cooling is drawn from Kentucky Lake at 633,000 gal/min. Spent water, raised in temperature ca. 10 deg F is released into a rectangular discharge harbor of 82 acres from which it is discharged into the main lake. Plankton collection in the harbor and main lake showed no significant increase in productivity associated with steam plant discharge. Tremendous numbers of shad were observed in the discharge harbor during winter months, probably attracted by warm water rather than plankton. The abundance of sauger and skipjack was related to the numbers of threadfin shad. All were rare in the harbor after March 15 when the temperature approached 60 deg. At that time, blue catfish, channel catfish and bluegill began to concentrate in the harbor. The catfish left the harbor in July when the temperature exceeded 80 deg. Fish population in the harbor differed greatly from the main lake where white bass, white crappie and large mouth bass predominate. Temp. of harbor - 51 to 55 deg, Lake - 41 to 45 deg. (Malaney-Vanderbilt)
W69-09321

TRANSLOCATION OF PHOSPHORUS IN A TROUT STREAM ECOSYSTEM,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife; and Institute for Fisheries Research, Ann Arbor, Mich.
Robert C. Ball, and Frank F. Hooper.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Fort Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Inst of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 217-228. 4 fig, 7 tab, 16 ref.

Descriptors: *Translocation, *Phosphorus radioisotopes, *Trout, *Streams, *Ecosystems, Radioactivity, Biota, Cycles, Michigan, Invertebrates, Fish, Temperature, Tracers, Sampling, Periphyton, Aquatic plants, Background radiation, Geochemistry, Spring waters, Phosphorus, Organophosphorus compounds, Bacteria, Diatoms, Detritus, Cycling nutrients, Light intensity, Fertilization, Growth rates, Equilibrium, Chara, Algae, Ammocetes, Lampreys, Omnivores.
Identifiers: Michigan, Cheboygan County, Sturgeon River, Fluorescein, Macrophytes, Ground solids, Uptake, Consumer organisms, Simulium, Physa, Salmo trutta, Entosphenus lamottenii, Gammarus, Cordulegaster.

To explore movement of phosphorus in a cold-water stream and relationships between phosphorus and stream productivity, spikes of approximately 23 millicuries of phosphorus-32 (P-32) were added to the water during three summers. The loss pattern varied from year to year, with much uptake apparently attributed to periphyton and three aquatic macrophytes. P-32 rate of loss from plants to water decreased with time and concentration approached equilibrium level in 15 to 20 days after spike was released. Decrease change rates suggested that plants were removing re-cycled phosphorus from the stream water. Highest uptake by periphyton occurred in 1958 and 1960; lowest in 1959. This pattern was reversed by aquatic macrophytes. Concentration curves for consumer organisms reflected differences in metabolic turnover rates and food relationships. In Simulium, concentrations quickly rose to a high level, seemingly during passage of the spike. Other small filter feeders and periphyton scrapers also accumulated P-32 rapidly, then lost it quickly. Accumulating P-32 was slower for large omnivorous stream insects and smaller predacious forms. Differences in circulation through the ecosystem, as noted during the 3-year test period, may be due to distribution of P-32 between soluble and particulate phases. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09334

THE PHOSPHORUS PROBLEM,
Department of the Interior, Washington, D.C.
Kenneth M. Mackenthun.
J Amer Water Works Ass, Vol 60, No 9, p 1047-1054, Sept 1968. 2 tab, 32 ref.

Descriptors: *Phosphorus, *Nutrients, *Eutrophication, *Tertiary treatment, Nitrogen, Aquatic plants, Bottom sediments, Dredging, Harvesting of algae, Fish harvest, Vitamins.
Identifiers: *Waste water (Municipal and industrial), *Phosphorus sources, *Nuisance plant growths, *Nutrient control, *Phosphorus concentrations, Micronutrients, Aquatic ecosystem, Midge larvae, Lake stratification, Surface area (Lakes), Phaedactylum, Waste water diversion, Instream treatment, Bottom sealing, Lake dilution.

Reduction of wastewater phosphorus inflows to receiving waters is necessary to check accelerating cultural eutrophication. Minimizing phosphorus inflows to surface waters is recommended because it is the most easily reduced of all constituents in waste waters essential to aquatic plant growth. The author suggests that prevention of biological nuisances requires total phosphorus concentrations not exceeding 100 micrograms/liter at any point in flowing water; and 50 micrograms/liter where water enters a standing body (lake or reservoir). The most effective means of controlling phosphorus levels in lakes now are treatment of nutrient point sources, waste water diversions around lakes, and dilution within lakes where feasible. Once nutrients are combined within the ecosystem of the receiving water, their removal is tedious and expensive. Results of harvesting of aquatic crops, dredging, and other means to remove nutrients after they have reached receiving waters should be compared with inflowing nutrient quantities to evaluate effectiveness. The preservation of surface waters in a usable state will depend in the long run on maximum nutrient removal at the waste sources. (Ketelle-Wis)
W69-09340

THE PHOSPHORUS FRACTIONS AND THE TURNOVER TIME OF INORGANIC PHOSPHORUS IN DIFFERENT TYPES OF LAKES,
Toronto Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W69-09342

THEORY OF THE CHEMOSTAT,
Microbiological Research Establishment, Salisbury (England).
E. O. Powell.
Laboratory Practice, Vol 14, No 10, p 1145-1149 and 1161, Oct 1965. 6 fig, 21 ref.

Descriptors: *Growth rates, *Kinetics, *Microorganisms, Mathematical models, Mathematical studies, Theoretical analysis.
Identifiers: *Chemostats, *Continuous culture, *Substrate-limited growth, Growth kinetics, Microbial nutrition.

The kinetics of continuous culture is discussed with special emphasis on its relevance to the operation of chemostats. In spite of much simplification, the author feels that the basic equations relating the steady-state concentrations of nutrients and organisms provide a useful description of the operation of chemostats. The principal defects are considered to be the assumed dependence of growth rate upon nutrient concentration, and the assumption that the yield is a constant. (Uttormark-Wis)
W69-09347

RADIATION AS A TECHNIQUE IN SOIL BIOLOGY AND BIOCHEMISTRY,
California Univ., Davis. Coll. of Agriculture.
For primary bibliographic entry see Field 02K.
W69-09350

RESPONSE OF CHEMOAUTOTROPHIC NITRIFIERS TO FOREST CUTTING,
Yale Univ., New Haven, Conn.; and Dartmouth Coll., Hanover, N.H.
For primary bibliographic entry see Field 02K.
W69-09351

ON THE CONSEQUENCES WHICH LOWERINGS OF THE WATER LEVEL FOR AGRICULTURAL PURPOSES HAVE ON MACROPHYTIC AND PLANKTONIC COMMUNITIES OF SHALLOW LAKES WITHIN THE OLIGOTROPHIC AREA OF SOUTH SWEDEN, (GERMAN),
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 02H.
W69-09352

A SYSTEMS APPROACH TO WATER POLLUTION,
Cornell Univ., Ithaca, N.Y.
Daniel P. Loucks.
Water Wastes Eng, p 43-45, July 1969. 3 p, 2 fig, 6 ref.

Descriptors: *Systems analysis, *Water pollution control, *Mathematical models, *Optimization, *Stream improvement, Political constraints, Public benefits, Decision making, Technical feasibility.

A systems approach to the problem of water pollution control and the implications of politics and social welfare in decision making were discussed. A hypothetical water pollution control system was formulated and mathematical techniques were applied for determining control methods for obtaining optimum stream standards. The utility of the information obtained to decision makers was discussed. It was concluded that although a systems approach could help individuals identify their choices in the order of preference, it was only in a political setting that the approach could have any relevance to public problems. (Thiuri-Cornell)
W69-09356

5D. Waste Treatment Processes

NATURAL DRAUGHT COOLING TOWERS - FERRYBRIDGE AND AFTER,
Institution of Civil Engineers, London (England).
I. W. Hannah, and P. R. Owen.
Proceedings of the Conference at the Institution of Civil Engineers held June 12, 1967, London, William Clowes and Sons, 1967. 113 p.

Descriptors: *Cooling towers, *Structural design, Mathematical models, Wind, Wind pressure, Stress analysis.
Identifiers: *Wind loading, *Structural failure, Vibration of cooling-tower shells, Aerodynamic problems.

This book contains the proceedings of the conference held at the Institution of Civil Engineers on June 12, 1967, which centered on cooling tower design and the Ferrybridge failure. The subjects discussed pertain to natural draught cooling towers. Reports on the resume of the report on the failures, structural philosophy, and the philosophy of failure are included. The second part of the proceedings contains reports on mathematical aspects of tower design, vibration of cooling-tower shells, and consequential problems at other stations in Great Britain. The third part discusses wind records and their application to structural design, some aerodynamic problems of grouped cooling towers, aerodynamic implications of the Ferrybridge research investigations, and problems of estimating wind loading on structures with special reference to cooling towers. There is a discussion following each of the three sections and a general discussion at the conclusion of the book. (Ross-Vanderbilt)
W69-09041

AERODYNAMIC IMPLICATIONS OF THE FERRYBRIDGE RESEARCH INVESTIGATIONS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
H. J. Lowe, and D. J. W. Richards.
IN Natural Draught Cooling Towers - Ferrybridge and After, The Institution of Civil Engineers, p 79-84, 1967. 6 p, 5 fig, 3 tab, 7 ref.

Descriptors: *Cooling tower, *Stress analysis, *Meteorological data, *Strain measurement, *Reynolds number, Wind pressure, Simulation analysis, Structural design.
Identifiers: *Ferrybridge, Wind loading, Wind tunnel, Transcritical region, Membrane stresses.

The Paper critically examines the aerodynamic investigations which were undertaken in support of the Ferrybridge investigations, and their implications. It concludes that there is no reason to doubt the general validity of the data but that there is an urgent need to obtain confirmatory full-scale measurements, to develop wind-tunnel techniques in which atmospheric turbulence is simulated, and to provide a method of stress analysis which incorporates the dynamic response of the tower. The important influences of tower shape, site configuration, and fluctuating leads on wind-induced tower stresses, were noted. Membrane stresses were shown to be sensitive to relatively small variations in the mean pressure distribution over the tower surface, and thus changes in tower shape or groupings. (Sherman-Vanderbilt)
W69-09042

CHEMICAL AND BIOCHEMICAL ASPECTS OF DISPOSAL OF USED GROUNDWATER BY RECHARGING (DUTCH),
Drinkwaterleiding der Gemeente Rotterdam (Netherlands).
J. J. Rook.
De Ingenieur, p G88-G92, Dec 20, 1968. 4 p, 1 fig, 1 tab.

Descriptors: *Ground water recharge, *Artificial recharge, *Applied water management, Water disposal, Water control, Water pollution effects, Chemical properties, Physical properties, Thermal pollution, Bacteria.

This paper discusses the various aspects in the methodology of recharging groundwater, after its use, into the subsoil. The principal conditions in this respect are the following, which are treated in detail: freedom from solid suspended material, absence of gases (both possible agents in clogging and undesirable chemical reactions), preclusion of bacterial activities, prevention of unacceptable rise in temperature. (Sherman-Vanderbilt)
W69-09054

THE PROBLEMS OF ESTIMATING WIND LOADING ON STRUCTURES WITH SPECIAL REFERENCE TO COOLING TOWERS,
National Physical Lab., Teddington (England). Aerodynamics Div.
For primary bibliographic entry see Field 08A.
W69-09055

A WATER-QUALITY HIERARCHY FOR ARID LANDS,
North Carolina Univ., Chapel Hill. School Public Health.
Daniel A. Okun.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 289-296, University of Arizona Press, Tucson, 1969. 8 p, 19 ref.

Descriptors: *Water reuse, *Potable water, Public utilities, Arid lands, Arizona, Water conservation, Taste, Reclamation (Waste water), Water utilization, Competing uses, Water supply, Water shortage, Public utilities, Water distribution (Applied), Water pollution, Viruses, Chemical wastes, Planning.
Identifiers: *Water-quality hierarchy.

As population increases and additional waters become polluted, direct reclamation and reuse of waste waters is rapidly becoming a necessity, especially in arid regions. Public acceptance of this varies in relation to experiences and attitudes. Treatment plants have been shown to be ineffective in elimination of many viruses that are present in wastewater. Also many chemical wastes of low concentration can be deliterious to health with long term use. It is proposed that municipalities in watershort areas, where less than 10 per cent of the water used is required to be of drinking-water quality, have a dual system. One system could consist of a high-quality potable supply for drinking and culinary purposes and the second system, with a lesser-quality supply, would serve for flushing, washing, lawn irrigation, and other nonpotable uses. Cost of dual supplies are discussed and it is concluded that they would be significantly reduced if the two systems were planned and installed simultaneously. This would be facilitated in new cities. The development of a hierarchy of water supplies based on water quality offers a reasonable approach to conserving this resource. (See W69-09210). (Sherbrooke-Ariz)
W69-09213

IMPORT ALTERNATIVES,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W69-09220

SANITARY LANDFILL DESIGN,
University of Western Ontario, London; and Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05E.
W69-09235

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 02F.
W69-09261

SENSORS FOR THE ANALYSIS AND CONTROL OF BIOLOGICAL PROCESSES,
Metropolitan Sanitary District of Greater Chicago, Ill. Research and Development Lab.
For primary bibliographic entry see Field 05A.
W69-09265

COOLING TOWERS: PROBLEMS....AND SOME TREATMENT PRACTICES,
Magnus Chemical Co, Inc.
Thomas F. Dalton.
Water Works and Wastes Engineering, Vol 2, p 53-56, Dec 1965. 1 tab, 13 ref.

Descriptors: *Cooling towers, *Cooling water, *Maintenance, *Algicides, *Corrosion control, *Dispersion, Recirculated water, Oxygenation.
Identifiers: *Alkaline cleaning, *Acidic cleaning, Scale preventors, pH adjustment, Bleed-off.

Because cooling towers are in continual use, they must be diligently maintained. Problems in the cooling system and chemical treatment selection factors according to water pollution control ratings are discussed. The following suggestions consider both overall effectiveness and cost of the chemical: Sodium chromate or sodium nitrate as corrosion inhabitors; chlorine as an algicide, polyphosphates or EDTA as scale preventors; sulfuric acid for pH adjustment; a precalibrated conductivity meter connected to a blowdown valve for bleed-off; sodium lignosulfonate as a dispersing agent. Both alkaline and acidic cleaning are recommended. Other uses for cooling water or cooling towers mentioned, are as a hot water recirculating system or as part of a modified activated sludge process. (Sherman-Vanderbilt)
W69-09316

HYPERBOLIC COOLING TOWERS WITH RESERVOIR STORAGE OF MAKEUP TO SERVE THE PROPOSED KEYSTONE GENERATING STATION,
Gilbert Associates, Inc., Reading, Pa., and Pennsylvania Electric Co., Johnstown.
Alexander F. Smith, III and Ralph E. Bovier.
Proceedings of the American Power Conference, Vol 25, p 406-415, 1963. 5 fig, 1 tab, 3 ref.

Descriptors: *Power plants, *Reservoir storage, *Cooling towers, *Waste-water treatment, *Thermal pollution, *Design criteria, Stream flow, Fuels, Transmission lines, Cost comparisons, Sites, Condensers.
Identifiers: *Pennsylvania, *Mine-mouth stations, *Keystone plant, Hyperbolic cooling towers.

This article describes the studies which led to the site selection of Keystone generating stations, indicating that large plants can be located on small streams, and proposes cooling arrangements which overcome specific difficulties at a location. The effect of discharges on stream flows during normal and critical years is shown. Coal resources and cost studies and a plant site survey were conducted. Hyperbolic cooling towers were chosen because they were economical for large unit installations with high load factors, they required less space than other units, and their stack heights (approximately 300 ft) minimized fog and air pollution problems. The tower's heat load can be increased by increasing either the water flow or the cooling range. The optimum cooling range was evaluated at 23 deg to 30 deg F. A makeup reservoir is most advantageous because of its mobility. A cost comparison with another river site concluded that the normal economic penalties of a cooling tower plant were not serious if the advantages of a closed-loop cooling tower arrangement were recognized. (Sherman-Vanderbilt)
W69-09318

MUSKEGON COUNTY PLAN FOR MANAGING WASTE WATER.
Muskegon County Board of Supervisors; and Bauer Engineering, Inc., Chicago, Ill.

Muskegon County Metropolitan Planning Commission, Mich, 1969. 130 p, 20 tab, 16 fig, 2 append.

Descriptors: *Land reclamation, *Water management, *Irrigation systems, *Nutrients, *Water quality, Water resources, Land development, Land management, Water quality control, Phosphates, Nitrates, Irrigation.
Identifiers: Muskegon County (Mich).

This report presents a metropolitan plan for enhancement which recognizes waste water as a resource out of place in the environment and seeks to utilize it productively in a program of comprehensive treatment including irrigation of agricultural and forest lands. This plan attempts to coordinate goals, problems, and opportunities of the metropolitan region with physical and engineering factors of water resource and waste management. Two basic precepts in the formulation of this plan are the concept of wastes as resources out of place and the conversion of open-ended management systems to closed systems. The first precept simply means that waste products or pollutants in one part of the water system might be resources in another place. The open system is typical of existing waste water systems where the wastes are ultimately discharged from the system. A closed system, however, retains the wastes by re-utilization. These precepts have been applied in the development of a waste water management system based on the utilization of treated waste water for irrigation. Muskegon County presently has large tracts of land unsuitable for agriculture due to lack of water and soil nutrients. The use of waste water would make this land productive through the addition of water and soil nutrients, especially nitrates and phosphates. In this particular case this technique served as potential aids in the solution of two basic problems of the area. First, the degraded water quality of water bodies in Muskegon County would be improved by the elimination of the discharge of waste water into the water bodies. Second, the scheme proposed would help to ameliorate a depressed economy in the area. The improvement in water quality would provide opportunities for a recreation industry which is presently minimal. The use of waste water nutrients for irrigation purposes would expand the agricultural sector which is presently underdeveloped. (Davis-Chicago)
W69-09331

DESIGN OF SANITARY SEWAGE COLLECTION SYSTEM BY ELECTRONIC COMPUTER,
Polytechnic Inst. of Brooklyn, N.Y. Dept. of Civil Engineering.
H. F. Soehngen, and P. R. DeCicco.
Soc Econ Planning Sci, Vol 1, No 3, 391-402, July 1968. 12 p, 11 fig.

Descriptors: *Design, *Sanitary engineering, *Sewage treatment, *Optimization, *Flow measurement, Mathematical models, Systems analysis, Sewers, Monitoring, Harbor.

The development of a systems approach to sanitary sewers design was discussed and a mathematical flow model developed. The project had two primary objectives, (a) to produce a computer oriented design which would produce results in less time with less cost and with a higher level of precision and (b) to utilize the memory and speed capability of the computer for optimal sewer design by using iterative techniques which allowed opportunity for redesign with continuous monitoring of cost implications. The integrated computer systems developed were applied to the Merrick Harbor Collection District in Nassau County. Definite economic advantages were observed. Total construction costs were minimized and engineering design costs were substantially reduced. (Thiuri-Cornell)
W69-09364

COMPUTER CONTROL ASPECTS OF AN ACTIVATED SLUDGE TREATMENT PLANT,
Goodyear Tire and Rubber Co., Akron, Ohio.
Ernest J. Neugroschl.
IFAC, Haifa Symp, Comput Contr Nat Resources, Public Util, Sept 1967. 36 p, 12 fig, 11 ref.

Descriptors: *Activated sludge, *Optimization, *Mathematical models, *Automatic control, *Water pollution control, Waste water treatment, Monitoring, Computers, Simulation, Biochemical oxygen demand.
Identifiers: Indianapolis Treatment Plant.

A mathematical steady state model was developed and the services of a computer employed for optimizing the process of pollution control by an automated activated sludge treatment plant. The goal of the study was to devise a plan for automatic control of the treatment plant by creating and maintaining optimum process conditions despite variations in influent flow and concentration; by (1) achieving optimal coordination of variables so as to remove the desired amount of waste, (2) reducing plant operating cost and (3) increasing protection against process failure through continued surveillance and monitoring. Average daily influent flow rates and biochemical concentrations (BOD) obtained from the Indianapolis Treatment Plant were used for a simulation of the control scheme. (Thiuri-Cornell)
W69-09369

SYSTEMS ANALYSIS OF THE ASSIMILATIVE CAPACITY OF STREAMS,
Public Health Service, Philadelphia, Pa. Delaware Estuary Comprehensive Study.
For primary bibliographic entry see Field 05G.
W69-09374

FOR BETTER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09375

STATE BOARD OF HEALTH SEWER SYSTEMS AND SEWAGE TREATMENT PLANTS.

17 SC Code Ann 248-250 (1962).

Descriptors: *South Carolina, *Sewage disposal, *Sewage treatment, *Regulation, Legislation, Sewage effluents, Sanitary engineering, Sewage lagoons, Oxidation lagoons, Sludge disposal, Sludge treatment, Water pollution, State governments, Conduits, Future planning, Engineering structures, Design, Soil structure, Filtration, Settling basins, Industrial wastes.
Identifiers: *State Board of Health.

No sewage shall be discharged into waters or on land in a manner adversely affecting public water supplies or causing a nuisance. No person or other entity shall construct or alter any sewage facility until complete plans have been approved by the State Board of Health. All plans submitted must contain specifications and an engineer's report. The engineer's report shall include: present and projected sewage flow needs based on population; character of industrial wastes; type of purification method proposed; character of soil through which sewers will be laid and portion which will be below ground water level sewage system components; and complete information on the body of water into which the final effluent is to be discharged. Statutory specifications for settling chambers, sludge digestion chambers, contact beds, trickling filters, and filter sand must be met. The discharge of sludge or screening into watercourses is prohibited. Sewage stabilization pond design, and construction must conform to statutory requirements concerning loading, shape, depth, inlets, outlets, dikes, pond bottoms, fencing, buffer zones and operation. Special dispensation may be given for temporary systems. (Harris-Fla)
W69-09405

POLLUTION CONTROL EFFORTS: 'TELL THE WORLD ABOUT IT'.
For primary bibliographic entry see Field 05G.
W69-09444

5E. Ultimate Disposal of Wastes

SUBSURFACE DISPOSAL: PRECAUTIONARY MEASURES,
Department of Energy, Mines and Resources (Canada).
D. D. McLean.
Ind Water Eng, Vol 6, No 8, p 20-22, Aug 1969. 3 p, 3 fig, 1 tab.

Descriptors: *Waste disposal, *Injection wells, Aquifers, Aquicludes, Permeability, Porosity, Water chemistry, Industrial wastes, Chemical wastes, Waste water disposal, Waste water treatment.
Identifiers: Injection well operation and design.

Rules for the dependable construction, installation, and operation of waste injection wells are outlined. One of the most important and least understood considerations is the history and effect of the liquid waste after it is injected into its receiving formation. Ideally, the sedimentary formation should be uniform sandstone, limestone, dolomite, or fractured shale of large areal extent with sufficient thickness, porosity, and permeability. Injection horizons should have adequate overlying and underlying aquicludes, low pressure, and be separated from freshwater horizons. Formation fluids should be compatible with injected fluids and no unplugged wells should penetrate the injection formation near the disposal well. The size and weight of the casing is important depending on the pressures and depths encountered and the volume of fluid to be injected. Larger injection strings reduce wellhead injection pressures, but oversize holes are more costly to drill. Injection rates can be increased via chemical or mechanical stimulation. Such methods not only effectively increase the porosity of the critical region of the well bore but also reduce the chance of plugging. To accurately evaluate the hydrologic properties of the disposal formation, injectivity tests should be made. A disposal operation must include a properly designed monitor program to detect failure of various components. (Knapp-USGS)
W69-09234

SANITARY LANDFILL DESIGN,
University of Western Ontario, London; and Illinois State Geological Survey, Urbana.
R. N. Farvolden, and G. M. Hughes.
Ind Water Eng, Vol 6, No 8, p 26-28, Aug 1969. 3 p, 1 fig, 1 photo, 3 ref.

Descriptors: *Landfills, *Waste disposal, *Sanitary engineering, Garbage dumps, Water pollution control, Environmental sanitation, Public health, Aquifers, Aquicludes, Groundwater movement, Soil water movement, Drainage.
Identifiers: Sanitary landfills.

Sanitary landfill design criteria to minimize pollution of ground and surface waters are listed and discussed. The best way to minimize water contamination is to keep the landfill unsaturated. When the fill must be at or near the zone of saturation, the hydrologic conditions must be selected to prevent fast migration of leachate, or to provide convergent flow toward collection sites. Examples of collection sites include slopes near streams or valleys; or where ditches, drains, and pumping wells may be constructed. An aquiclude under the landfill prevents downward percolation of leachate to underlying aquifers. It is becoming more and more common to plan a landfill site for ultimate use as a recreational facility. Piling the refuse into hills is commonly practiced. While there are obvious advantages to this procedure, there are some disadvantages. Again, spoil (for covering the refuse during daily operations) must be hauled to the dumping face at the top of the hill, which is much more expensive than having it piled adjacent to the dumping face, as in the trench-and-fill method. Also, the flow of groundwater in the vicinity of the site is controlled by the groundwater mound that develops under the hill of refuse. Springs of objectionable leachate should be anticipated in every case where the waste is piled in hills. (Knapp-USGS)
W69-09235

DISPOSAL OF BRINE EFFLUENTS FROM INLAND DESALTING PLANTS: REVIEW AND BIBLIOGRAPHY,
Bureau of Reclamation, Washington, D.C.
G. W. DePuy.

Office of Saline Water, Research and Development Progress Report No 454. July 1969. 211 p. OSW 14-01e0001-1306.

Descriptors: *Brine disposal, *Brines, *Saline water, *Soil sealants, *Canal linings, Waste disposal, Effluents, Ponds, Reservoir leakage, Evaporation, Evaporation pans, Costs, Desalination plants, Asphalt emulsions, Asphaltic concrete, Concrete linings, Bituminous materials, Bibliographies, Water pollution, Rubber, Seepage losses, Reviews, Earth linings.
Identifiers: *Seepage control, *Salt recovery, Evaporimeters, Canal sealants, Asphalt membranes, Plastic film, Evaporation reservoirs.

The Bureau of Reclamation has been authorized by the Offc. of Saline Water to conduct an 8-part program on surface facilities for disposal of desalting plant effluents. The program consists of: (1) preparing a state-of-the-art bibliography and a review, (2) test soil samples from a proposed brine evaporation pond site, (3) laboratory tests on pond lining materials and soil sealants, (4) develop a monitoring system for seepage loss measurement, (5) develop techniques for increasing evaporation rates, (6) conduct field tests of pond linings and develop optimum application methods, (7) prepare a manual on surface facilities for disposal of desalting plant effluents, and (8) conduct an economic study of salt disposal. This review and bibliography was prepared as Part I of the Bureau's program. The technical literature was reviewed for information on all parts of the Bureau's program. A survey of 50 states and the Federal Water Pollution Control Administration on water pollution regulations pertaining to surface facilities for disposal of desalting plant effluents is appended to the review. The bibliography contains 870 references. References are indexed and cross referenced according to 18 subject areas. (DePuy-Bur of Reclam)
W69-09353

SPRAY SYSTEMS - A METHOD OF INCREASING WATER EVAPORATION RATES TO FACILITATE BRINE DISPOSAL FROM DESALTING PLANTS,
Bureau of Reclamation, Washington, D.C.
W. G. Smoak.
Office of Saline Water Research and Development Progress Report No 480, Sept 1969. 19 p. OSW 14-01-0001-1306.

Descriptors: *Saline water, *Waste disposal/sprays, *Brine disposal, *Evaporation, Cooling water, E nergy balance, Vapor pressure, Spraying, Temperature.
Identifiers: *Evaporation reservoirs, Spray evaporation.

A short study was undertaken to determine the general effectiveness of using spray systems to increase the evaporation f water from desalting plant brine disposal ponds. Spraying tests were made with 100 ft. square test and control ponds. The ponds were calibrated over a 2-week period. Measuring instruments installed at the ponds included: (1) hook gages, (2) staff gages, (3) a totalizing anemometer, (4) a hygrothermograph, and (5) thermocouples for recording water surface temperature and average bulk temperature. Using 12 hollow-cone spray nozzles, evaporation increases (ranging from 18% to 59%) were experienced with spray rates of 32 gpm to 60 gpm, respectively. (Smoak-Bur of Reclam)
W69-09354

5F. Water Treatment and Quality Alteration

ELIMINATION OF THERMAL STRATIFICATION IN RESERVOIRS AND THE RESULTING BENEFITS (with special emphasis on study of Lake Wohlford, California),
Geological Survey, Washington, D.C.; and Escondido Mutual Water Co., Calif.
Gordon E. Koberg, and Maurice E. Ford, Jr.
Geological Survey Water-Supply Paper 1809-M, 1965. 28 p, 14 fig, 1 tab, 13 ref.

Descriptors: *Thermal stratification, *Reservoirs, *Thermal pollution, Solar radiation, Wind, Mixing, Evaporation, Water quality.
Identifiers: Lake Wohlford (Calif.), Surface heating, Surface cooling, Floating aerator, Air-bubbling system, Plastic hose air-distribution system, Temperature prediction.

Thermal stratification in lakes and reservoirs increases the concentration of certain undesirable substances in the hypolimnion with an accompanying decrease in the dissolved-oxygen concentration. The temperature distribution within a lake is a function of diffusion and conduction, and such external agencies as solar radiation, wind, inflow, and outflow. The use of air bubbling to artificially induce mixing, successful in several investigations reported in the literature, is studied in detail in Lake Wohlford in collaboration with the Escondido Mutual Water Co. of Escondido, California. The results of the Lake Wohlford study indicate that the air-bubbling system is economically feasible to remove undesirable taste and odors from the water used for domestic purposes and to increase the dissolved-oxygen concentration in the hypolimnion of the lake. The results also indicate that the elimination of thermal stratification can reduce evaporation. The Lake Wohlford study and other tests cited have not presented enough data to define criteria for design of an air-bubbling system for a thermally stratified reservoir of a given capacity. Further studies are needed so criteria can be established. (Ross-Vanderbilt)
W69-09029

PRACTICAL CONTRIBUTIONS TO ASSURE NORMAL BIOLOGICAL CHARACTERISTICS OF DRINKING WATER (ROMANIAN),
Servan Constantinescu, and Ana Ionescu.
Hidrotehnica, Gosp Apelor, Meteorol, Vol 13, No 3, p 142-146, Mar 1968. 5 p, 7 fig, 1 tab, 6 ref.

Descriptors: *Water treatment, *Oligochoctes, *Iron bacteria, *Water supply, Sources, Biological properties, Water properties, Chlorine, Chlorination, Potable water.
Identifiers: *Romania, Bucharest water supply, Water chlorination.

The problem of eliminating animal and vegetal organisms from drinking water was mostly restricted to experimental work. This paper discusses a method of improving the biological properties of water. Many chemical, physical, and biological analyses were performed in the Bucharest area to determine the occurrence of Oligochaete worms in water. Results indicate the presence of Ferrobacteria such as Crenothrix, Leptothrix, Siderocapsa, etc, and Oligochaete worms such as Nais, Stylaria, and Aeolosoma. It was also found that Ferrobacteria which take their energy from iron components, constitute the substrata for the development of Oligachaete worms. Negative pipeline pressures resulting from interruptions in pumping, or excessive water use, were presumed to be associated with the problem. The worms were not found in water from catchments, treatment stations, intakes, reservoirs or pumping stations. Hydraulic and hydropneumatic washings were made to remove the crusts of iron compounds, particularly limonite, as a possible energy source for ferrobacteria. Laboratory experiments were conducted by using copper sulfate, aluminum sulfate, sodium chloride and chlorine. Later, slow and shock chlorination methods were used successfully to remove hazardous bacteria and worms from the drinking water. (Carstea-USGS)
W69-09288

A SYSTEMS APPROACH TO WATER POLLUTION,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05C.
W69-09356

APPLICATION OF OPTIMAL CONTROL THEORY TO A CLASS OF RIVER AERATION PROBLEMS,
RUTGERS - The State Univ., New Brunswick, N.J.
B. Davidson.
Appl Syst Anal Sanit Eng, Proc, 4th Annu, AAPSE, Workshop, Clemson Univ, p 11-1 -- 11-6, June 1969. 6 p, 7 fig.

Descriptors: *Aeration, *Optimization, *Control systems, *Design, *Pollutants, Water quality control, Analog computers, Digital computers, Stream improvement, Numerical analysis.
Identifiers: Pontryagin's Extremum Principle, Sirazetdinov-Tarassov-Perlis algorithm.

Optimal Control Theory was explained for lumped and distributed parameter systems using the artificial instream aeration problem as an illustrative example. The presentation commenced with a discussion of modern, state-space control theory for systems of ordinary differential equations followed by a statement of Pontryagin's Extremum Principle. The algorithm was then applied to the optimal design of steady-state, artificial aeration for polluted rivers. Distributed parameter optimization and the Sirazetdinov-Tarassov-Perlis algorithm was then presented and its application to the unsteady-state or optimal start-up aeration problem was discussed. Examples of numerical problems were given. Both analog and digital computers were used in obtaining optimal results. (Thiuri-Cornell)
W69-09359

DITTMAN V NAGEL (BREACH OF WARRANTY OF WELL WATER).

168 NW 2d 190-196 (Wis 1969).

Descriptors: *Wisconsin, *Potable water, *Water pollution, *Wells, Consumptive use, Water quality, Bacteria, Water pollution sources, Legal aspects, Judicial decisions, Remedies, Damages, Relative rights.
Identifiers: *Warranty.

Plaintiff brought action to recover damages for an alleged breach of an express warranty that a well on property purchased from defendants produced an adequate supply of water fit for human consumption. At trial, plaintiffs testified that when they took occupancy on May 30, 1965, the well was producing polluted water. Defendants testified that the well water was safe up to and including May 28, 1965, the day they moved from the premises. The trial court awarded damages and defendants appealed. The appellate court reversed on the grounds that the evidence didn't support the verdict. The court agreed that the warranty was binding as to both the quantity and quality of the water. However, the court held that a warranty to be breached must be breached at the time of sale. The date of sale most favorable to the plaintiffs was May 7, 1965. No evidence was presented to prove the water was polluted at any time before May 30, 1965. The burden of proof is on the party relying on breach of warranty to show the breach of that warranty. Plaintiffs did not meet that burden. (Gabrielson-Fla)
W69-09410

5G. Water Quality Control

THERMAL POLLUTION OF WATER SYSTEMS,
Rutgers - The State Univ., New Brunswick, N.J.
For primary bibliographic entry see Field 05B.
W69-09039

DEBATE ON THERMAL ISSUE CONTINUES.

Environmental Science and Technology, Vol 3, No 5, p 425-427, May 1969. 3 p.

Descriptors: *Thermal pollution, *Water pollution effects, *Waste water treatment, *Legal aspects, Power plants, Cooling towers, Lagoons, Public utilities, Construction costs.

Identifiers: *Water Quality Improvement Act, *Federal Power Commission, Columbia River Study, Connecticut River Study.

Thermal pollution control problems are discussed with reference to pending legislation. Water treatment projects by public utility industries are deterred because of their cost which is estimated at $1.8 billion dollars in 5 years. These companies are funding studies of water pollution effects, however. Larger and more concentrated heat loads are predicted with substantiating data. Columbia and, lticut River Studies are preparing mathematical models of the biological effects of heat loading. Licensing of the plants may soon require compliance with water quality standards to be decided by state agencies. Various cooling facilities are described with examples of existing construction. Cost is dependent on the choice of the system and cannot be generalized for: cooling lagoons, cooling towers, mechanical draft (forced or induced blower systems), natural draft. (Sherman-Vanderbilt)
W69-09047

COMMONWEALTH V NEW YORK AND PENNSYLVANIA CO. (EQUITABLE RELIEF FROM STREAM POLLUTION).

367 Pa 40, 79 A 2d 439-448 (1951).

Descriptors: *Pennsylvania, *Pollution abatement, *Industrial wastes, *Water pollution, Judicial decisions, Legal aspects, Remedies, Water law, Rivers, Public health, Administrative decisions, Water pollution control, Regulation, Abatement, Water quality control, State governments.
Identifiers: *Public nuisance.

Plaintiff, the Commonwealth of Pennsylvania, brought an action to abate a public nuisance created by the discharge of industrial wastes into the Clarion River. The lower court denied relief upon the grounds that the Sanitary Water Board under the Pure Streams Act of 1937 had exclusive control to determine public nuisances resulting from stream pollution. The plaintiff appealed. It was clear that defendant had polluted the Clarion River to the detriment of public health. Their actions were being reviewed by the Sanitary Water Board when plaintiff sought equitable relief. On appeal plaintiff gained relief. The court held that it was not the purpose of the 1937 act to supplant former or future actions in equity to abate public nuisances in streams. The strong public policy of the state was to abate public nuisances and the 1937 act only supported the equitable or common law remedies. When the public waters were corrupted by pollution a determination by the Sanitary Water Board that such was a public nuisance was not a pre-requisite to obtaining equitable relief. (Holt-Fl a)
W69-09060

SIZING UP ANTI-POLLUTION LEGISLATION,
Laurence W. Ross.
Chemical Engineering, Vol 74, No 15, p 191-196, July 17, 1967. 6 p, 18 ref, 2 tab.

Descriptors: *Water Quality Act, *Water quality control, *Water pollution, *Standards, Air pollution, Analytical techniques, Pollutants, Water pollution control, Water pollution effects, Pollution abatement, Color, Acidity, Turbidity, Bacteria, Industrial wastes, Water supply, Water types, Domest ic water, Potable water, Recreation facilities, Wildlife, Water util ization, Federal government, Federal-state water rights conflicts, Legislation, Chemical wastes, Legal aspects, Industries.

This country is faced with pressing problems from both air and water pollution. The Wat er Quality Act of 1965 is a good focal point for discussion regarding water pollution. Under that act the states are required to establish standards acceptable to the Department of the Interior or the Department will set the standards. Federal authority is to be invoked only if the states do not act. The state standards must include specific criteria and a plan for enforcement. The plan will be evaluated with respect to various types of water supplies and requirements. The criteria established by the states must be general enough to allow the states to respond to technological advances. The criteria should cover bact eria, dissolved oxygen, pH, and temperature, and be dependent on the anticipated water use. The 'Water Quality Criteria' is an excellent basis for evaluation of chemical plant discharges. The specialty industries such as food and textile are the most vexing to the authorities who must establish the criteria. Color and turbidity present the biggest problems of water pollution. The timetables for enforcement will allow older industries that cannot reform ample time to terminate. (Shevin-Fla)
W69-09061

AIR POLLUTION, WATER POLLUTION, INDUSTRIAL COOPERATION AND THE ANTITRUST LAWS,
Philip K. Verleger, and Jennie M. Crowley.
Land and Water L Rev, Vol 4, No 2, p 475-486, 1969. 12 p, 34 ref.

Descriptors: *Pollution abatement, *Water pollution, *Industrial wastes, *Federal government, Water pollution treatment, Legislation, Industrial plants, Water utilization, Control, Operations, Standards, Social aspects, State governments, Legal aspects, Judicial decision, Regulation, Competition.

In order to effectively abate industrial pollution, cooperation is needed among the industries both in the fields of research and operation. This cooperation may possibly bring these industries into direct conflict with Federal Antitrust laws. These regulations may be used to attack industry for conspiring in violation of the Sherman and Clayton Acts even if there is an effort on the part of industry to collectively agree to engage in certain practices which would aid in reducing pollution. In order for the problem of pollution to be solved, cooperation among competitors in industry must take place, and there must be added cooperation f rom state and federal government. Industries are regulated by government and there is a basic constitutional right among the regulated to collectively discuss the demands of the regulator. State and federal legislation dictate rules for the industry as regards pollution; however, the industrys' right to discuss collectively their ideas of this problem must be protected and not be allowed to fall prey to antitrust legislation. (Shevin-Fla)
W69-09062

WHAT PRICE A QUALITY ENVIRONMENT,
Jack W. Carlson.
Journal of Soil and Water Conservation, Vol 24, No 3, p 84-88, May-June 1969. 5 p, 2 ref.

Descriptors: *Cost-benefit analysis, *Pollution abatement, *Future planning (Projected), *Project benefits, Public benefits, Pollutants, Air pollution, Water pollution control, Costs, Long-term planning, Environment, Cost analysis, Cost trends, Cost-benefit ratio, Management.

Attempting to abate pollution implies that environmental quality goals have been assessed. Goals must vary with cost, and cost of quality control must not exceed the damage inflicted. Costs and benefits, then, must be measured. Benefits are often difficult to measure because we lack adequate environmental quality or social indicators. There are problems with determining the nature of human well-being, measuring aesthetic and health benefits, and projecting benefits into the future for future generations. Costs of improvements are easier to measure than benefits, but analysts should be wary of using simple calculation methods. All of the new data that are now available must be utilized in order to prevent inflated cost estimates. A recent federal study found that costs were much lower than expected. Costs to industry are only a fraction of one percent of the value added. Consumers could finance abatement with a similar fraction of annual income. Management of environmental quality is extremely important, and this can best be done if management institutions can encompass the location where they originate and cause damage. (Douberley-Fla)
W69-09063

VIAN V SHEFFIELD BLDG. AND DEV. CO. (SUIT TO ENJOIN DISCHARGE OF SEWAGE).
88 NE 2d 410-415 (Ct App Ohio 1948).

Descriptors: *Ohio, *Sewage, *Surface drainage, *Prescriptive rights, Pumping plants, Sewage effluents, Sewage disposal, Surface waters, Drainage, Sewers, Ditches, Lake Erie, Beaches, Discharge (Water), Legal aspects, Judicial decisions, Relative rights, Industrial wastes, Alteration of flow.

Plaintiff herein was seeking to enjoin defendant building and development company from: (1) discharging surface waters upon plaintiff's property; and (2) casting sewage and/or disposal plant effluent thereupon through the use of ditches and sewers. The court found that plaintiff had failed to sustain the burden of proof of showing that defendant had in fact diverted and cast surface waters upon plaintiff's property. The court further held that in accordance with Ohio law one may not obtain by prescription or otherwise than by purchase a right to cast sewage upon the lands of another without his consent. Plaintiff met his burden of proof in showing that defendant had caused sewage to flow upon plaintiff's property, and the request for an injunction was granted. (Logan-Fla)
W69-09064

ALL HE WANTS TO DO IS SAVE THE WORLD,
Gilbert Rogin.
Sports Illustrated, Vol 30, No 5, p 24-29, Feb 3, 1965. 6 p.

Descriptors: *Conservation, *Pollution, *Natural resources, *Public benefits, Air pollution, Social aspects, Wildlife conservation, National parks, National forests, Preservation, Scenery, DDT, Insecticides, Environmental sanitation, Air pollution effects, Injunction, Damages, Ecology, Mosquitoes, Pollution abatement, Drainage, Lakes, Public rights, Michigan, New York, Remedies, Legal aspects.
Identifiers: *Environmental Defense Fund, Everglades.

The Environmental Defense Fund and its attorney, Victor Yannacone, are probably this country's most 'militant' conservationists. They do not look for the answers for preserving our natural resources by writing letters to the editors or by lobbying in legislatures, but rather, have taken their battle to the courts. EDF's court actions have not sought damages, but have been brought on behalf of a class seeking injunctive relief and a declaration of the public's rights. Its biggest battle to date has been against the use of DDT. EDF has yet to receive a favorable court holding but a decision of a New York judge stated that while legislation was required he determined that DDT is harmful. In Michigan, EDF was successful in getting several cities to agree to stop using DDT. EDF's biggest test lies ahead in a pending suit against a paper plant in Montana which the organization declares is polluting the air of the Missoula Valley. The organization is only handcuffed by lack of funds. EDF's next battle, if possible, will be the problem of alligator poaching. (Shevin-Fla)
W69-09078

HEALTH AND SAFETY (ADMINISTRATIVE AUTHORITY FORMATION).

Del Code Ann tit 16, sec 1401-1421 (Supp 1966).

Descriptors: *Delaware, *Administration, *State governments, *Sewage disposal, Legislation,

Sewage, Sewage system, Water system, Waste treatment, Administrative agencies, Cities, Water, Waste, Municipalities, Financing.

This statute creates and organizes an authority to exercise public and essential governmental functions necessary to provide for public health and welfare. The powers granted by this chapter are not to be exercised in a duplicative or competitive manner with regards to existing utilities, public or private, serving substantially the same purposes. Revenue bonds may be issued by the created authority for the purpose of paying the whole or any part of the cost of any project. The fees, rates, and charges of each authority shall be fixed so as to pay the operating, maintenance, and repair costs of the pertinent sewage system. Also included within the purview of this chapter are provisions concerning the conditions under which property owners must connect with the sewerage system. (Moulder-Fla)
W69-09089

PURE WATERS BOARD.
Ill Ann Stat ch 19, secs 1001-1008.13 (Smith-Hurd Supp 1969).

Descriptors: *Water resources development, *Illinois, *Administrative agencies, *Water supply, Coordination, Planning, Legislation, Administrative costs, Leadership, Adoption of practices, Decision making, Procurement, Water resources planning, Project planning, Programs, Evaluation, Financing, State governments, Publications, Agriculture, Conservation, Forecasting, Governors, Future planning (Projected), Investigations.

The Pure Wat ers Board is created to provide sound planning and maximum coordination of the efforts of state agencies in water resources development and planning. The Board shall consist of the directors of the various state agencies involved in water resources. Members of the Board are to receive no pay. The chief of the Division of Water and Natural Resources shall be the technical secretary to handle the Board's business when it is not meeting. The Board may call on any state educational institutions, board or department for assistance. The Board may request these bodies to carry on studies for the Board's biennial assessment of the adequacy of state water supplies. The Board may also employ consultants. The Governor and General Assembly shall receive the Board's biennial assessment. Also the Governor shall receive the Board's recommendations on programs to insure adequate water supply. Publications informing the public of the existing conditions of the state water resources are to be prepared by the Board. It shall examine all water resources projects, existing and proposed, and send recommendations about them to the G overnor. In matters of policy concerning projects involving state departments and the United States the Board will represent the state. The Board shall appoint regional water resources commissions to plan for regional water resources. (Gadd-Fla)
W69-09123

RIVER CONSERVANCY DISTRICTS.
Ill Ann Stat ch 42, secs 383, 392a, 394, 401, 403, 404, 409 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Water conservation, *Pollution abatement, Legislation, Water law, Legal aspects, Jurisdiction, Water pollution control, Highways, Taxation, Projects, Judicial decisions, Political aspects, Water resources, Water utilization, Ditches, Sewers, Assessments, Construction, Financing, Channels, Beds under water.
Identifiers: Conservancy districts, Special assessments.

Whenever unified control of a lake or river system becomes necessary, a conservancy district may be formed after approval of a petition presented by a specified number of voters to the circuit court and upon approval in a general election of qualified voters within the proposed district. The board of trustees of any conservancy district has certain enumerated powers and duties so that it may carry out its assigned corporate functions. The district may const ruct sewers, channels, and ditches along or under highways and may establish necessary pipes and conduits on the beds under the surface of state waters. The board is charged with prevention of pollution within its jurisdiction and may appoint a sufficient police force to enforce laws relating to this duty. Special assessment and general taxation are the two methods by which district projects are financed. The board is specifically charged with seeing that parties responsible for pollution cease activities which are the cause thereof. (See also W69-09126 thru W69-09128). (Johnson-Fla)
W69-09125

RIVER CONSERVANCY DISTRICTS.

Ill Ann Stat ch 42, secs 383, 392a (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Administrative agencies, *Water conservation, *Water utilization, Flood control, Pollution abatement, Legislation, Legal aspects, Water law, Jurisdiction, Political aspects, Water pollution, Water pollution control, Sewage, Water supply, Drains, Ditches, Sewers, Bridges, Eminent domain, Electric power production, Construction, Bridge construction, Condemnation, Maintenance.
Identifiers: Conservancy districts.

Whenever unified control of a lake or river system or a portion thereof is deemed conducive to the prevention of stream pollution, control or prevention of floods, disposal of sewage or provision of domestic, industrial or public water supplies one per cent of the legal voters may initiate a petition for the formation of a river conservancy district. Such petition must be brought before the circuit court which passes upon its necessity after a public hearing. If approved by the court, a general election of the voters in the proposed district is held in which a majority of those voting must approve the formation of the district. The powers and duties of the board of trustees include the cleaning out, widening, or deepening of any drain, sewer, river, pond or water course, constructing and maintaining ditches, sewers and canals, constructing and enlarging bridges in the district, and holding, purchasing or condemning real or personal property, but not furnishing water power or electricity for private use or otherwise. (See W69-09125). (Johnson-Fla)
W69-09126

RIVER CONSERVANCY DISTRICTS.

Ill Ann Stat ch 42, secs 394, 401, 403 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Water utilization, *Water conservation, *Water pollution control, Administrative agencies, Legislation, Legal aspects, Water law, Recreation facilities, Wildlife habitats, Water supply, Regulation, Water sources, Dams, Reservoirs, Water purification, Pumping, Pipelines, Costs, Sewers, Ditches, Drains, Highways, Construction.
Identifiers: Public waters.

The board of trustees may acquire land for use in construction of parks, recreational areas, wildlife areas and water supply. It may adopt and enforce regulations relating to protection of water sources as well as build dams and reservoirs for water storage, water purification works, pumping stations and pipelines for production and delivery of pure water to consumers. The board must sell water at rates that will at l east defray all fixed, maintenance and operating expenses and profits from such sale must be used for extention and improvement of water facilities. Each district may construct, maintain, and extend its sewers, pipelines, ditches and drains along or under highways, streets or alleys and may operate conduits and pipes, wholly or partially submerged, under the public waters of the state provided that permission for same is granted by the governor and that normal use of the waterbody is not impeded thereby. The board has the duty to prevent pollution of the water supply and may appoint and support a sufficient police force for same with jurisdiction not only within the district but also to as far as fifteen miles from the intake of such water supply. (See W69-09125). (Johnson-Fla)
W69-09127

RIVER CONSERVANCY DISTRICTS.

Ill Ann Stat ch 42, secs 404, 409 (Smith-Hurd 1956), as amended, (Supp 1969).

Descriptors: *Illinois, *Pollution abatement, *Water conservation, *Water utilization, Drains, Sewers, Laterals, Legislation, Water law, Water policy, Construction, Taxes, Sewage disposal, Administrative agencies, Jurisdiction, Water pollution control, Assessments, Financing.
Identifiers: Special assessments, Shore improvements, Sanitary dist·icts.

Construction of drains, sewers or laterals, septic tanks, water pipes, local shore improvements and dams and improvement of channels, beds and banks may be initiated by the board of trustees. Such projects may be financed by special assessment or general taxation. The board may contract with any sanitary district for sewage disposal within the conservancy district. Special assessments must be made in relation to the benefit gained by such projects; however, they may not be applied on property wholly outside the district. It is a primary duty of the board to see that pollution within the district is prevented and such board must cause all persons, parties, firms and corporations to cease pollution of all waters within the state, provided that in so doing the board does not supersede the authority of the Sanitary Water Board of the State of Illinois or its successor. (See W69-09125). (Johnson-Fla)
W69-09128

CHEMICAL CONTAMINANTS FOUND IN SURFACE AND SUBSURFACE WATER AS RELATED TO SOIL AND CLIMATIC CONDITIONS.
Maine Univ., Orono.

Project Completion Report, Maine Water Resources Center, August, 1969. 28 p, 17 tab. OWRR Proj A-006-ME.

Descriptors: *Insecticides, *Water quality, *DDT, *Endrin, Runoff, Sediment.
Identifiers: *Endosulfan.

Runoff was collected from plots maintained under various cropping systems. Samples were separated as to sediment and water and analyzed for pesticides and various elements. Pesticides were analyzed by electron capture gas chromatography whereas inorganic chemical elements were analyzed by atomic absorption and colorimetry. The concentration and amounts of endosulfan, endrin and DDT were lower in runoff from a rotation system of potatoes, sugarbeets and peas than from continuous potatoes. The amounts of insecticides in runoff were small compared to the amount applied. Less than one percent of the amounts applied were received in runoff. The concentration of the insecticides were considerably higher in the soil or sediment fraction of the runoff. A study on the retention of insecticides on two soils suspended in water showed that the insecticides tend to concentrate in the 0.08-0.5 mu clay fraction. The retention of the insecticides studied differed for the two soils studied. The intact Marshall soil retained more of each insecticide than the Caribou soil probably because of the higher organic matter content. In the clay fraction the retention was higher in the Caribou soil even though there is less organic

matter than in the Marshall. (See also W69-09229).
W69-09228

CHLORINATED INSECTICIDES IN RUNOFF WATER AS AFFECTED BY CROP ROTATION,
Maine Univ., Orono.
E. Epstein, and W. J. Grant.
Soil Science Society of America Proceedings, Vol 32, No 3, p 423-426, May-June 1968. 4 p, 6 tab, 20 ref.

Descriptors: *Pesticides, Erosion, *DDT, *Endrin, Gas chromatography.
Identifiers: *Endosultan.

The concentration and amounts of three chlorinated insecticides were lower in runoff from a rotation system of potato (Solanum tuberosum L.), oats (Avena sativa L.), and sod, than under continuous potato cropping. Runoff samples from natural runoff plots were collected following each storm, and the amounts of DDT, endrin, and endosulfan were analyzed with a gas chromatograph. The amounts of pesticides in runoff were small compared to the amount applied. The concentrations of the insecticides in the runoff (soil-water suspension) were generally greater than those found in the settled soil (sludge). (See also W69-09228).
W69-09229

ELECTRIC UTILITIES INCLUDE BUILT-IN SAFEGUARDS FOR ENVIRONMENTAL PROTECTION.

Environmental Science and Technology, Vol 3, No 6, p 523-525, June, 1969.

Descriptors: *Thermal pollution, *Air pollution, *Water pollution, *Waste treatment processes, Electric power plants, Engineering structures, Cost comparisons, Cooling towers, Reservoirs.
Identifiers: *Gilbert Associates Inc, *Keystone Power Station, *Homer City Power Station, *Conemaugh Power Station.

The design, cost, and efficiency of pollution control faci lities in the building of electric power plants is discussed in three sections: Water, ai r, thermal aspects. The three stations concerned are minemouth plants in Pennsylvania, Keystone (two 900 mw units), Homer City (two 640 units), Conemaugh (two 900 mw units). Water demand is reduced in the new plants by cooling towers, recirculating systems and storage reservoirs used to augment low flow streams in the summer and also as a neutralizer. New protection devices (oil skimmers, diversionary dams and ditches, and manhole appurtenances) were used to keep oil spillage from contaminating the streams. Electrical precipitators (95% efficiency) were used to control fly ash and high stacks were designed to avoid ground level concentration of SO2. Air quality levels are being tested at all three plants. Large electric stations can be located on small streams without pollution hazards if designed with water storage and hyperbolic natural draft types. Large cooling towers are the most economical of all systems. (Sherman-Vanderbilt)
W69-09302

NATURAL DISPLACEMENT OF POLLUTION FROM THE GREAT LAKES,
Oak Ridge National Lab. Tenn.
Robert H. Rainey.
Science, Vol 155, p 1242-1243, Mar 10, 1967. 1 fig, 1 tab, 3 ref.

Descriptors: *Great Lakes, *Model st udies, *Flow rates, *Eutrophication, Pollutants, Water pollution.
Identifiers: *Natural displacement.

A simplified mathematical model of a lake system (assumptions of equal flow rate to and from the lake, constant concentration of pollutants in streams entering the lake constant rate of pollution and distribution of pollutants in lake volume) indicates that if the pollution of the Great Lakes were discontinued, the natural flow through the lower Great Lakes would be sufficient to remove about 90 percent of the waste in about 20 years. On the other hand, hundreds of years would be required to displace the pollution from Lake Michigan and Lake Superior. Although the mathematical relationship ignores many factors influencing the contamination of lakes, it is a close representation of the lower Great Lakes because of their relative shallowness. Quantitative data is diagrammed. (Sherman-Vanderbilt)
W69-09311

A NEW CRITICAL PHASE OF THE LAKE WASHINGTON POLLUTION PROBLEM,
Washington Univ., Seattle. Dept. of Sanitary Engineering.
R. O. Sylvester.
Trend Engineering, Washington Univ, Seattle, Vol 8, p 8-10, Apr 1956. 2 fig, 7 ref.

Descriptors: *Water pollution sources, *Water pollution control, *Pollution abatement, Water supply, Sewage treatment, Washington, Eutrophication.
Identifiers: *Lake Washington, Sewer outfalls, Combined sewer systems, Lake fertilization, Aquatic plant nuisance, Effluent diversion, Nutrient reduction, Metropolitan Sewage Planning Agency, Washington, King County, Snohomish County, Seattle, Mercer Island, Bellevue Sewer District, Duwamish River.

Lake Washington, with approximately 38 square miles of surface water, is situated in the Seattle metropolitan area and supplies drinking water to 15,000 people. In addition to natural runoff from the urban area, outfall sewers from the metropolitan area discharged into the lake until 1941. Seattle's sewage is now diverted and treated outside the area, eventually reaching Puget Sound. However, combined sanitary and storm sewers frequently overload and mixtures of sanitary and storm sewage flow into the lake. Since 1941, ten additional treatment plants have been constructed which discharge treated effluent. Principal sources of lake pollution now are: (1) inflowing waters at north end, (2) overflows from Seattle's combined system, (3) septic tank leachates, and (4) overloads of treatment plants along shoreline. These sources still supply enough nutrients to cause a serious nuisance at some seasons. The solution may involve one, or a combination, of the following: (a) formation of a metropolitan sewerage planning agency, (b) complete elimination of sewage discharge by pumping all effluents to Puget Sound, (c) research on interrelationships between water temperature, algal growth, and nutrients to determine conditions under which increased nutrients could be tolerated without causing an extreme nuisance environment. (Ketelle-Wis)
W69-09339

WATER-QUALITY MANAGEMENT AND LAKE EUTROPHICATION: THE LAKE WASHINGTON CASE,
Washington Univ., Seattle. Dept. of Zoology.
W. Thomas Edmondson.
Water Resources Management and Public Policy, Washington Univ Press, Seattle, p 139-178, 1968. 2 fig, 1 tab, 104 ref.

Descriptors: *Lakes, *Eutrophication, *Sewage effluents, *Nutrients, *Nitrogen, Phosphorus, Sulfates, Vitamins, Algae, Growth rates, Copper sulfate, Bottom sediments, Lake Michigan, Washington, Dissolved oxygen.
Identifiers: *Effluent diversion, *Water quality management, *Lake Washington, *Sewage fertilization effects, *Biological productivity, Aquatic nuisances, Transparency, Agricultural runoff, Nutrient budgets, Comparative studies, Nutrient removal, Lake recovery, Wisconsin, Lake Monona, Lake Mendota, Lake Waubesa, Lake Kegonsa, Lake Zurich, Oscillatoria rubescens, Cladophora, Dinobryon divergens, Switzerland, Lake Lucerne, Lake Constance, Washington, Puget Sound, Bare Lake (Alaska), Lake Lyngby So (Denmark), Lake Tahoe (Calif), Lake Maggiore (Italy), Species dominance.

Lake Washington's case parallels other lakes worldwide where cultural eutrophication has led to increased biological productivity, limiting water uses. First definite indication of enrichment appeared in 1955 with abundance of Oscillatoria rubescens, followed by reductions in transparency and dissolved oxygen levels in water. Present solution to the problem has been almost total diversion of effluents from the lake, completed in 1967 at a cost of $85 million (including new treatment facilities). Evidence of the role of sewage in fertilization and lake deterioration comes from many sources: direct observation; urbanization followed by symptoms of increased lake productivity; nutrient budget studies, indicating relative nutrient percentages from different sources; comparison of similar lakes in different environments; changes resulting from sewage effluent diversions around lakes; bioassay techniques of lake water samples; and physiological studies of algae grown in nutrient solutions. The relative importance of various nutrients and maximum allowable concentrations in lakes are dependent on several interrelated factors including diverse effects of different combinations of nutrients, and variety in reactions by species to nutrients. Improved methods of nutrient removal from sewage will undoubtedly develop, but at present, effluent diversion is the only sure method of controlling enrichment of lakes. (Ketelle-Wis)
W69-09349

DAILY STREAMFLOW SIMULATION,
Sacramento State Coll., Calif.
For primary bibliographic entry see Field 06A.
W69-09355

THE USE OF DYNAMIC PROGRAMMING IN REGIONAL WATER QUALITY PLANNING,
Clemson Univ., S.C.
B. C. Dysart, III.
Appl Syst Anal Sanit Eng, 4th Annu, AAPSE, Workshop, Clemson Univ, p 10-1 -- 10-23, June 1969. 23 p, 3 tab, 14 fig.

Descriptors: *Dynamic programming, *River basins, *Optimization, *Pollution abatement, *Water quality control, Streamflow, Biochemical oxygen control, Dissolved oxygen, Reaeration, Treatment facilities.

Dynamic programming techniques were used to demonstrate the process of modelling a river basin for quality control. The objective of the research was to determine the least total cost treatment level or abatement policy required at each outfall to meet specified water quality standards. Only a single type of waste, biochemical oxygen demand, was considered. Consideration was given to the effects of changes in the system parameters such as streamflow, reaeration and deoxygenation rate coefficients and dissolved oxygen standards, on the basin cost and abatement policy. The procedure was found to be equally applicable for any other waste type for which transport or dissipation models existed. (Thiuri-Cornell)
W69-09358

SOME STOCHASTIC MODELS FOR WATER QUALITY CONTROL,
Cornell Univ., Ithaca, N.Y.
Daniel P. Loucks.
Appl Syst Sanit Eng, Proc, 4th Annu, AAPSE, Workshop, Clemson Univ, p 2-1 -- 2-11, June 1969. 6 p, 9 fig.

Descriptors: *Stochastic processes, *Water quality control, *Waste water treatment, *Markov

processes, *Optimization, Streamflow, Flow augmentation, River basins, Design criteria.

An application of stochastic models to problems of water quality control was discussed. The objective of the model was to determine the least cost combination of waste water treatment and flow augmentation required to maintain a specified stream quality. A Markov process was used as the basis of some stochastic optimization models for estimating the cost resulting from the imposition of probabilistic flow augmentation requirements for downstream water quality control. Given the minimum-cost function for various flows and their probabilities, the 'design' streamflow as well as the degree of waste water treatment at each source of waste within a river basin could be simultaneously examined to determine the least cost combination of waste water treatment and flow augmentation required to maintain specified water quality standards. (Thiuri-Cornell)
W69-09360

SYSTEMS ANALYSIS OF THE ASSIMILATIVE CAPACITY OF STREAMS,
Public Health Service, Philadelphia, Pa. Delaware Estuary Comprehensive Study.
Robert V. Thomann.
Proc Second Annu Water Quality Res Symp, Albany, NY, p 31-47, April 1965. 17 p, 5 ref.

Descriptors: *Systems analysis, *Water quality control, *Linear programming, *Optimization, *Waste assimilative capacity, Mathematical models, Delaware River, Pollution control, Oxygen demand, Administrative costs.

The basic concepts of systems analysis and their application for solving water pollution control problems were presented. A mathematical model was developed to solve water quality problems of the Delaware estuary using linear programming techniques. The goal of the study was to develop techniques for minimizing the overall cost of improving water quality in a situation where there were many waste sources all contributing in various degrees to the oxygen demand. It was shown that the techniques employed were useful in placing various water pollution problems (including the classical oxygen demand sag) in an analytical input-output framework which could then be further utilized in the formulation of optimum water pollution control policies. It was also shown that a variety of additional waste removals was necessary at each of the seven waste sources, that the Delaware estuary had many levels of waste assimilative capacity and that there were obvious problems associated with the least cost solution. (Thiuri-Cornell)
W69-09374

FOR BETTER POLLUTION CONTROL.
Textile Industries, Vol 133, No 6, p 65-69, 1969. 5 p.

Descriptors: *Textiles, *Biochemical oxygen demand, *Water pollution sources, Activated sludge, Chemical wastes.
Identifiers: *Starch, *Textile wastes, Textile sizes, Carboxymethyl cellulose, Polyvinyl alcohol, Dyestuffs.

Article based on staff interview at Industrial Waste Laboratory, Wesleyan University, Middletown, Conn. It is maintained by Conn. Water Resources Commission. The trend from cotton and wool to man-made fibers in past 15 years has reduced water pollution. Examples: Cotton mill previously averaged 100-200 lb BOD/1000 lb cloth, now about 50 lb. Starch size being replaced by carboxymethyl cellulose (CMC) and polyvinyl alcohol (PVA); acetic acid by ammonium sulfate; soaps by biodegradable detergents; 50-100 gal water/lb cloth dropped to 3 to 10 gal. Most textile treatment plants remove 90% plus BOD and 50-80% of color at $1.00 to $4.00/1000 lb cloth by activated sludge process. Effluent is often treated with chlorine and flocculant may be used in tertiary treatment. Article recommends four steps to textile plant facing pollution problem: (1) Employ a knowledgeable consultant; (2) Make a BOD survey and chemical process balance; (3) Reduce water usage and amount of high BOD chemicals. It is emphasized that the textile mills should work with municipalities to develop mutually advantageous cooperative systems of waste disposal. Constant care is needed in the use of new chemicals to prevent unexpected pollution problems. (Work-NC Stat Univ)
W69-09375

FOND DU LAC METROPOLITAN SEWERAGE DISTRICT V CITY OF FOND DU LAC (ESTABLISHING A SEWAGE DISTRICT).

166 NW 2d 225-230 (Wis 1969).

Descriptors: *Wisconsin, *Sewage districts, *Pollution, Judicial decisions, Sewage systems, Legal aspects, Urbanization, Public health, Cities, Local governments, Sewage disposal, Taxes, Administrative agencies, Legislation.
Identifiers: *Metropolitan sewer district, *Annexation.

The department of resource development ordered plaintiffs to solve their pollution problem. Plaintiffs, to avoid annexation by the defendant city, petitioned the courts to establish a metropolitan sewerage district. A state statute authorized such establishment upon a showing of need and fulfillment of procedural requirements. The defendants opposed this petition since it meant the furnishing of city facilities to town residents who paid no city taxes. The defendant argued that the statute was an unconstitutional delegation of legislative authority. The court found for the defendant. The court would have to answer 'What will be best.' and 'What should be.' in implementing the statute. These were clearly questions of policy that should be left to the legislature. Thus, the court felt that the statute was an unconstitutional delegation of legislative authority. The court did not decide the constitutionality of the districts, but only the method of their establishment. (Gadd-Fla)
W69-09415

WATER POLLUTION.

Vt Stat Ann tit 18, secs 1201-1217 (1968).

Descriptors: *Vermont, *Water pollution, *Administrative agencies, *Water pollution control, Regulation, Legislation, Legal aspects, Water law, Water policy, Jurisdiction, Judicial decisions, Water quality, Standards, Water quality control, Adminsitration, Administrative decisions, Riparian rights, Water rights, Environmental sanitation, Impaired water quality, Public health, Wastes, Water resources, Water utilization.

The state Board of Health has the duty of overseeing the sources, uses and quality of the water supply of towns, villages and public institutions in the interest of public health. It may prohibit the use of water from any source which examination shows not to be fit for public use. The Board may establish necessary regulations in this regard and advise individuals and villages on health considerations of proposed water and sewer systems. The discharge of sewage, drainage or other material which may cause pollution of any source of water for public use in prohibited. The court of chancery, upon application by the Board or any interested party, has jurisdiction over enforcement of rules and regulations promulgated by the Board and may restrain the use or occupancy of premises where violations are taking place until orders or regulations are compiled with. (Johnson-Fla)
W69-09420

FEDERAL WATER POLLUTION CONTROL.
Ill Ann Stat ch 19, secs 145.19-145.22 (Smith-Hurd 1963).

Descriptors: *Illinois, *Water pollution control, *Federal government, *Administrative agencies, State governments, Legislation, Local governments, Water pollution, Water pollution treatment, Pollution abatement, Project planning, Project purposes, Government finance, Government supports, Cooperation, Legal aspects.
Identifiers: *Water Pollution Control Act.

The Sanitary Water Board is designated as the water pollution agency for the state and for purposes of the federal Water Pollution Control Act 1948. In addition to other action necessary to carry out the above purposes, the Sanitary Water Board may: (1) cooperate with the Surgeon General of the United States and state or federal agencies pertaining to matters relating to water pollution; (2) apply for and receive federal funds under the Water Pollution Control Act; (3) approve projects for which application for loans is made under the Water Pollution Control Act by any municipality or agency; and (4) participate in proceedings under the Water Pollution Control Act and give consent to requests by the federal Security Administrator to the Attorney General of the United States for bringing suits for pollution abatement. (Kahle-Fla)
W69-09423

PURIFICATION OF WATERS--DRAINAGE OF PONDS.

Ill Ann Stat ch 24, sec 11-20-4 (Smith-Hurd 1962).

Descriptors: *Illinois, *Drainage, *Ponds, *Water purification, Watercourses (Legal), Canals, Land, Real property, Landfills, Abatement, Public health, Water quality, Legislation, Cities, Regulation, Water quality control, Local governments, Legal aspects.

The corporate authorities of each municipality may provide for the cleansing and purification of waters, watercourses and canals and, when necessary to prevent or abate a nuisance, may provide for the drainage and filling of ponds on private property. (Shevin-Fla)
W69-09434

DISCHARGE OF SEWAGE INTO OPEN DITCHES ALONG STREET OR HIGHWAY.
Ill Ann Stat ch 121, sec 9-123 (Smith-Hurd 1960).

Descriptors: *Illinois, *Drainage, *Sewage disposal, *Highways, Ditches, Legislation, Sewage, Septic tanks, Sewage effluents, Sewage treatment, Domestic wastes, Industrial wastes, Drains, Drainage systems, Adjudication procedure, Administrative agencies, Cities, Local governments, Jurisdiction, Legal aspects.
Identifiers: *Highway drainage, Penalties (Criminal).

No person shall discharge any sewage of any type, or cause the same to be discharged into open ditches, drains or drainage structures installed for highway drainage purposes. Persons violating this section are subject to fine. The highway authority having jurisdiction over any street affected by the violation may enter a complaint in the proper court. If the authority fails to act, any other person may enter such complaint. (Shevin-Fla)
W69-09440

POLLUTION CONTROL EFFORTS: 'TELL THE WORLD ABOUT IT'.

Textile Industries Vol 133, No 6, p 71-73, 1969. 3 p.

Descriptors: *Textiles, *Water pollution sources.
Identifiers: *Textile wastes.

A resume of a joint AATCC-U.S. Depts Commerce and Interior symposium on pollution control in the textile industry, Feb. 26-28, 1969. See Textile Chemist and Colorist, Vol. 1, No. 6, 142/21-156/35 and No. 7, 173/25-187/44, (1969). (See also W69-08551 thru W69-08558). (Work-NC State Univ)

W69-09444

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

MAKING ANALYTICAL TOOLS IN WATER RESOURCES MANAGEMENT USABLE,
TRW Systems Group, Redondo Beach, Calif.; and San Bernardino Valley Municipal Water District, Calif.
M. L. Frankel, and J. A. Beaver.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 431-438, 1968. 8 p, 1 tab, 4 ref.

Descriptors: *Water management (Applied), *Computers, *Data processing, *Model studies, Mathematical models, Analog models, Analog computers, Digital computers, Systems analysis, Operations research, Optimization, Simulation analysis, Management, Analytical techniques, Water resources development, Linear programming, Dynamic programming.
Identifiers: Water resources management techniques.

In the last ten years a formidable array of analytical tools has been developed in an attempt to manage water resources and water quality problems. In the past, each of these tools has come about as the result of a specific study directed at a specific set of problems. In order for the planners and managers to derive the maximum benefit from these past developments, an orderly classification scheme may be used to relate the specific conditions and problems of a region to the existing body of analytical tools, including mathematical models and computer simulations. In addition, the classification scheme permits an organizational outline for structuring the types of studies required in water resources and water quality management. (Knapp-USGS)
W69-09189

PRINCIPLES OF MODELLING AND PROSPECTS OF USING ELECTRONIC COMPUTERS IN HYDROLOGICAL FORECASTING,
Hydrometeorological Service of the USSR, Moscow.
E. G. Popov.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 448-455, 1968. 8 p, 6 ref.

Descriptors: *Forecasting, *Computers, Analog computers, Digital computers, Data storage and retrieval, Data processing, Flood forecasting, Streamflow forecasting, Hydrologic data, Gaging stations, Model studies, Mathematical models.
Identifiers: *USSR, Hydrologic data processing, Hydrologic forecast service.

The use of computers in the USSR for operational application in hydrological forecasting, particularly for snowmelt-rainfall-streamflow relations, is discussed. Flood models, numerical procedures, and determination of parameters for the forecasting of hydrologic events are described. Digital, analog, and hybrid computers are being developed and used for forecasting. Data storage, transmission, and processing are aided by computers working in the country's basic hydrologic data network. (Knapp-USGS)
W69-09191

RUNS OF PRECIPITATION SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Mathematics and Statistics.
For primary bibliographic entry see Field 07B.
W69-09250

A GAME THEORY APPROACH TO THE PROBLEMS OF INTERNATIONAL RIVER BASINS,
Harvard Univ., Cambridge, Mass.
Peter Rogers.
Water Resources Research, Vol 5, No 4, p 749-760, Aug 1969. 11 p, 3 fig, 4 tab, 9 ref.

Descriptors: *Optimization, *Optimum development plans, Linear programming, Mathematical model, Multipurpose development, Water Management (Applied), Flood control, Systems analysis, Simulation.
Identifiers: *Optimizing models, *Game theory, Lower Ganges, Brahmaputra.

The lower Ganges and the Brahmaputra rivers flow out of India and join together in the province of East Pakistan to form one of the major river systems in the world. Each year the rivers flood during the monsoon, causing loss of life and great damage to crops and property. The problem is futher excerbated by the fact that the best flood control points in the basin are not under the political control of Pakistan, which suffers most from the floods. The number of possible combinations of structural and non-structural variables for this river system is so large that conventional methods of analysis are inadequate. We demonstrate that by use of systems analysis techniques, including linear programming and game theory, we are able to consider a rational plan to control the floods while taking advantage of the possibilities for multi-use projects including flood control and other uses for the river, such as power production, irrigation, navigation, and salinity control. Moreover, using the concepts of game theory we are able to investigate a range of strategies for cooperation between the two riparian nations which will result in significant benefits to each. (Marriott-Chicago)
W69-09327

DAILY STREAMFLOW SIMULATION,
Sacramento State Coll., Calif.
Kip Payne, W. R. Neuman, and K. D. Kerri.
J Hydraul Div ASCE, p 1163-1179, July 1969. 17 p, 2 tab, 15 fig, 19 ref.

Descriptors: *Streamflow forecasting, *Simulation analysis, *Markov processes, *Regression analysis, *Optimization, Water quality control, Flood routing, Flow measurement, Hydrographs, Gaging stations, Monthly, Peak flow.

A daily multiple-station streamflow simulator was developed using a first order Markov chain and regression analysis. The study employed streamflow simulation techniques to get optimal flood regulation and routing for water quality control and fisheries during low flow periods. Historic flow records on the Calapooia River in Oregon were analyzed and the hydrographs rearranged to reduce the observed variations of flow within any particular day and between each day. Rearrangement of flows consisted of distributing the monthly peak or peaks of the hydrographs about particular days in order that the ascension and recession curves of the arranged flows occurred on particular days. Daily flows were simulated on the basis of the statistical properties of the rearranged flows. A dampening factor was introduced into the simulator for the purpose of producing non-historic flow sequences with statistical distributions similar to the historic distributions for the annual flows. (Thiuri-Cornell)
W69-09355

AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
California Univ., Berkeley; and Resources for the Future, Inc., Washington, D.C.
Pinhas Zusman, and Irving Hoch.
Amer J Agr Econ, Vol 50, No 5, p 1635-1646, Dec 1968. 12 p, 1 tab, 1 fig, 15 ref.

Descriptors: *Dynamic programming, *Capital, Water resources, Optimization, Leontief models, Water supply, Mathematical models, Investment, Interest, Planning, Growth rates, Constraints, California.

A dynamic programming model in which existing capital capacities and available primary resources served as constraints was developed. It was applied to the problem of water resources development in the State of California in a general equilibrium analysis which considered all sectors of the economy simultaneously. The objective of the study was to determine an optimum program of trade and investment, including investment in water resource systems. The Leontief Model analytical technique was employed and the period from 1955 through 1961 was studied in order to allow comparison with actual performance of the economy. The most striking finding was that despite the high rate of economic growth (6.6 per cent annual rate of growth in state income) the economically efficient water supply was practically stagnant. The existing capacity of the medium-cost water-supplying industry was not utilized at all and at times (1957-1959) even the low cost water supply capacity was not fully exploited. (Thiuri-Cornell)
W69-09362

SIMULATION OF FLOOD FLOW DIVERSION FROM A LAKE SYSTEM,
Southern Methodist Univ., Dallas, Tex. Inst. of Tech.; and Northwestern Univ., Evanston, Ill. Technological Inst.
Jerry R. Rogers, and Robert S. Gemmell.
Proc, Third Annu Amer Water Resources Conf, p 285-294, Nov 1967. 10 p, 2 tab, 3 fig, 3 ref.

Descriptors: *Simulation analysis, *Flood control, *Stochastic processes, *Lake Michigan, Monte Carlo method, Hydrograph analysis, Diversion, State-discharge relations, Flood routing, Overflow.
Identifiers: The Chain of Lakes.

A simulation model based on flooding on the Chain of Lakes (Grass, Fox, Nippersink and Pistakee Lakes) and the assessment of flow diversion to Lake Michigan as a means of reducing flood damages was developed. The study was directed at the evaluation of water export as a means for controlling floods on a small lake system. Stochastic flood simulations were based on the history of lake level fluctuations and an estimate of the stage volume relationship for the lakes. The lake data was reduced to probability distributions and flows generated by Monte Carlo (random number) sampling techniques. A generated large flood sequence was selected for sensitivity analysis of diversion capacity and overflow elevation. The flood peak reduction results with changing diversion size were exhibited. The hydrographs showed that a small change in diversion size would not appreciably alter the flood peak. The use of General Purpose Systems Simulation language facilitated the construction of the computer model for simulation of lake flooding and diversion. (Thiuri-Cornell)
W69-09365

OPTIMIZATION OF WATER PLANNING USING A SPECIAL PURPOSE COMPUTER,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering; and Elbit Computers Ltd., Haifa (Israel).
D. Karmeli, A. Shani, and Y. Gadish.
IFAC, Haifa Symp Comput Contr Nat Resources, Public Util, Sept 1967. 52 p, 7 fig, 4 ref.

Descriptors: *Optimization, *Linear programming, *Mathematical models, *Water management (Applied), *Irrigation efficiency, Computers, Planning, Network design, Topography, Data storage and retrieval.

The factors that influence income, expenses and expected profit were examined in a study directed to the formulation of linear programming techniques to determine the allocation and the production factors that would lead to optimal irrigation methods and water planning. Using a computer, detailed water planning was combined with

the basic solution for the production factors. Water allocation detailed to the hourly supply was specified with consideration of the existing network, the topography, the daily consumption and the irrigation system. Calculations of optimal water planning were presented in the appendix. The possibility of using an inexpensive computer for the calculations was examined. (Thiuri-Cornell)
W69-09367

THE APPLICATIONS OF THE TECHNIQUES OF SPACE TECHNOLOGY TO WATER RESOURCE CONTROL,
TRW Systems, Redondo Beach, Calif.; and TRW Systems, Houston, Tex.
J. A. Aseltine, and C. V. Stableford.
IFAC , Haifa Symp Compu Contr Nat Resources, Public Util, September 1967. 15 p, 4 fig.

Descriptors: *Optimization, *Water resources, *Mathematical s, *Digital computers, *Systems analysis, Monitoring, Design, Size, Locating, Time analysis.
Identifiers: Space technology.

The possibility of applying space technology techniques to solve water resource problems was discussed. The objective of the study was to employ mathematical expressions and digital computer instructions used for solving space problems for launching an attack on the problems of water resource control. Systems design techniques consisting of prediction models would be employed to generate time projections of levels and flows under various conditions. The guidance and control techniques could be applied to control flows within a water system. Optimization techniques would be applied to such problems as location and size of a dam or interconnection between basins, or for the determination of the best number and locations of monitoring instruments. (Thiuri-Cornell)
W69-09368

THE OPTIMAL YIELD OF AN AQUIFER,
Technion - Israel Inst. of Tech., Haifa.
J. Bear, and O. Levin.
Int Ass Sci Hydrol, Symp Haifa, p 401-412, March 1967. 12 p, 5 fig, 4 ref.

Descriptors: *Optimization, *A quifer characteristics, *Groundwater recharge, *Distribution patterns, *Markov processes, Pumping plants, Planning, Mathematical models, Constraints.

Mathematical programming techniques were employed to establish the criterion of 'optimal yield' rather than 'safe yield' for planning the utilization of groundwater aquifers. The planning criterion was the maximization of the objective function subject to all constraints involved. The problem of planning the groundwater utilization was formulated with this criterion. The proposed approach was introduced through the analysis of a simple model representing a homogeneous strip of a coastal aquifer, which included a pumping and recharge installation. The problem of the optimal operation of the system during a given number of time units was presented as a conditional planning problem. Once the rules of the optimal operation of the system for the various seasons as well as the initial conditions were known, it was possible to compute, using a deterministic model, all future states of the system. The distribution functions could be likewise computed using a stochastic model incorporating Markov chains. Quantities of water to be pumped and recharged in the future could be similarly estimated. (Thiuri-Cornell)
W69-09371

SYSTEMS ENGINEERING AND AQUIFER MANAGEMENT,
Technion - Israel Inst. of Tech., Haifa.
Nathan Buras.
Int Ass Sci Hydrol, Symp Haifa, p 466-473, March 1967. 8 p, 2 fig.

Descriptors: *Linear programming, *Dynamic programming, *Simulation analysis, *Optimization, *Aquifer characteristics, Mathematical models, Subsurface waters, Water resources development, Annual costs, Design criteria.
Identifiers: Southern California, Indus Valley, Israel.

The application of linear programming, non-linear programming, dynamic programming and simulation techniques for determining least cost operation rules for the coordination of surface and subsurface water resource facilities was presented. Three examples of aquifer management using systems approach in Southern California, in the Indus Valley and in Israel were given. In Southern California simulation techniques were used for the derivation of operating policies. For the Indus Valley mathematical models were constructed for the various components of a complex hydro-agronomic system. These models were evaluated through simulation. In Israel a sequential decision problem was analyzed using dynamic programming. In all cases, however, the aquifers were viewed as components of complex water resource systems. Their utilization was optimized within the overall system. In two of the examples (Indus Valley and Israel) quality considerations weighed heavily in the derivation of design criteria on operation rules. (Thiuri-Cornell)
W69-09373

6B. Evaluation Process

WHAT PRICE A QUALITY ENVIRONMENT,
For primary bibliographic entry see Field 05G.
W69-09063

LAND, WATER, AND SOCIAL INSTITUTIONS,
Carnegie-Mellon Univ., Pittsburgh; and Arizona Univ., Tucson.
Courtland L. Smith, and Harland I. Padfield.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 325-336, University of Arizona Press, Tucson, 1969. 12 p, 36 ref.

Descriptors: *Water resources development, *Social aspects, Geographical regions, Institutional constraints, Institutions, Optimum development plans, Planning, Project planning, Coordination, Social participation, Social function, Tennessee Valley Authority Project, Social function, Metropolitan Water Dist. of So. Cal.
Identifiers: Salt River Valley (Ariz), Gezira Scheme, Sudan, Yaqui River Basin, Mexico, Niger River Project, Sudan, Israel.

This paper emphasizes the need to consider social institutions and cultural diversity in the development of world water resources. Understanding of human behavior requires focusing on both the people-in-action or the system of action and the blueprint for behavior or the culture of the people. Most social institutions have both an integrative function and a boundary maintenance function. For water resource development the closeness of the unity between the territoriality of the people-in-action and the spatial availability of the water affects the success of the water development scheme. The waterspace concept states that for each economic development scheme, careful and detailed study must be made of the territorial and cultural aspects of the social institutions involved. A case history of waterspace is traced in the development of the Salt River Valley of Arizona. Several other examples are provided from culturally divergent and geographically widespread areas. The importance of cultural factors is shown in examples from the water development problems of several countries. Successful economic development is enhanced where careful consideration is given to the territoriality of the existing and created social institutions. The blueprint for behavior of people occupying a given waterspace must complement demands of development. (See W69-09210). (Sherbrooke-Ariz)
W69-09214

HISTORICAL BACKGROUND AND PHILOSOPHICAL BASIS OF REGIONAL WATER TRANSFER,
Idaho Univ., Moscow. Water Resources Research Inst.
C. C. Warnick.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 340-352, University of Arizona Press, Tucson, 1969. 13 p, 6 fig, 1 tab, 62 ref.

Descriptors: *Water transfer, *Inter-basin transfers, Arid lands, Southwest U.S., Distribution patterns, Import, Irrigation canals, Water conveyance, Water demand, Water distribution (Applied), Arizona, California, Future planning (Projected), Projected benefits, Projected planning, Human population, Social aspects, Federal jurisdiction, History, Colorado River.

It is concluded that a regional water transfer, although difficult to define, does entail out-of-basin diversion and has a noticeable impact on the socio-economic well being of the area. An historical review, beginning 6,000 yrs. ago in the Near East, concludes with descriptions of the Colorado River Aqueduct and the Rocky Mountain Trans-mountain Diversions. Population increase, economic growth and the solution of the Arizona Valley Cal., et al case related to Colorado River water allocation has resulted in development of many conceptual plans for rather vast regional water transfer. Information on these projects has been summarized in a table. The philosophical justification for regional water transfer is discussed in terms of the following: (1) regional growth and economic expansion, (2) social welfare, (3) wisdom of visionary leaders, (4) agencies ambition and (5) professional challenge. Present authorities advocate more study and are seeking more alternatives for the solution of water needs in arid-land regions. Time required for planning and accelerated technological change make it difficult to reconcile the problem of water needs at hand. (See W69-09210). (Sherbrooke-Ariz)
W69-09215

ECONOMICS OF LARGE-SCALE TRANSFERS,
Resources for the Future, Inc., Washington, D.C.
Charles W. Howe.
IN W.G. McGinnies and B.J. Goldman, Arid Lands in Perspective, p 374-382, University of Arizona Press, Tucson, 1969. 9 p, 4 tab, 20 ref.

Descriptors: *Interbasin transfers, *Cost-benefit analysis, Water transfer, Arid lands, Export, Import, Cost comparisons, Project planning, Water costs, Long-term planning, Project benefits, Short term planning, Comparative costs, Cost-benefit theory, Direct benefits, Direct costs, Economic evaluation, Economic justification, Estimated benefits, Indirect benefits, Indirect costs, Agriculture, Irrigation water.

Current projects of interbasin transfer of water differ from past projects by increased size and higher potential for conflict between exporting and importing regions. This paper sets out to answer the questions, 'Are total social benefits from the transfer sufficient to offset the total costs,' and 'Will water users be able and willing to pay a price for water which will cover project costs'. Empirical studies show direct benefits to be fairly low compared to prospective costs of new water supplies. This implies that the economic feasibility of new supplies will depend upon indirect benefits and that user charges sufficiently high to cover the costs of providing the water will probably not be possible. Secondary benefits are analyzed and the possibility that they are balanced by secondary disbenefits is considered. Empirical studies of total benefit show that the period of immobility is a crucial factor which must be studied carefully. The costs of several proposed large-scale transfers are presented. Estimates of costs and benefits suggest that large-scale transfers are at best marginal for all areas at present, but that their use in providing water for already established, highly specialized agricultural areas which will be exhausting their

water supplies in an area of potential application. (See W69e09210). (Sherbrooke-Ariz)
W69-09219

PHILOSOPHICAL CONSIDERATIONS OF WATER RESOURCE IMPORTATION,
Dean F. Peterson.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 398-405, University of Arizona Press, Tucson, 1969. 7 p, 18 ref.

Descriptors: *Water transfer, *Ethics, *Water allocation (Policy), Arid lands, Interbasin transfers, Decision making, Local governments, Social values, Water resources development, Water pollution effects, Political aspects, Political constraints, Legal aspects, Social aspects, Conservation.
Identifiers: Philosophical considerations.

This paper is concerned with two related topics; (1) the ethical dimensions of the concepts of minimizing man's interference with nature in constrast to his desire to conquer nature, and (2) the ethical concepts related to our historical water policies and their relation to the concept of large-scale water transfer. The man-nature theme vs. conquest of nature and the ethics of pollution problems are discussed. The history of U.S. water policy, a reflection of philosophy, is traced. Political equity and income redistribution are discussed in relation to policy formation. Benefits from water importation are considered in terms of regional differences in states of development. The importance of real objectives (vs. procedures) and sovereignty is related to water decision making. General solutions based on ethical considerations do not appear possible, but every effort should be made to construct and debate ethical arguments in both generalities and for specific cases so that our decisions might be the best possible. (See W69-09210). (Sherbrooke-Ariz)
W69-09221

CANADIAN WATERS AND ARID LANDS,
Department of Energy, Mines and Resources, Ottawa (Ontario).
E. Roy Tinney, and Frank J. Quinn.
IN W.G. McGinnies and B.J. Goldman, Eds., Ari d Lands in Perspective, p 411-415, University of Arizona Press, Tucson, 1969. 5 p, 2 tab, 3 fig.

Descriptors: *Water transfer, *Water policy, United States, Interbasin transfers, Water resources development, Legal aspects, Economy, Governments.
Identifiers: *Canada.

This paper attempts to present Canadian thinking and positions on the possibility of international large-scale transfer of Canada's water resources. It is emphasized that no official contact has been made between governments on this subject and that all water authorities in the U.S. are not convinced of the need for international diversion. Some of the major points in Canadian thinking are: (1) Canadian waters are a national, not a continental, resource; (2) no market presently exists for Canadian water in the U.S.; (3) Canada would be unwilling to sell water until completion of an inventory of its own future needs; (4) Canada is presently inventorying water resources; (5) both federal and provincial governments in Canada must concur on any negotiations; (6) sale conditions could not jeopardize permanent ownership and repatriation if and when needed in Canada. It is apparent that the question of exporting Canadian water to the U.S. arid lands is premature: quite simply, there is no buyer and no seller. (See W69-09210). (Sherbrooke-Ariz)
W69-09223

THE ROLE OF THE ECONOMIST,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
Bruce R. Beattie.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 416-417, University of Arizona Press, Tucson, 1969. 2 p, 4 ref.

Descriptors: *Water transfer, *Decision making, *Economic evaluation, Interbasin transfers, Economic prediction, Economic impact, Economic justification.

This paper discusses the role of the economist in the social decision-making process and how the economist, given the present state of his art, might best fulfill this role with regard to the issue of interbasin water transfer. The economist is obligated to provide positive analysis of the economic implications of alternative social actions and to be careful not to imply or leave the impression that the optimum arrived at, given the technical criteria of economics, has any more or less normative significance regarding the total problem than do optima of other technical disciplines. It is the economist's role to act as an expert consultant to decision-makers, but he can not replace decision-makers. The key economic variables in water transfer are the value productivity of water in the area of destination, the value productivity of water in the area of origin, and the cost of transfer. In addition to recounting the direct and indirect effects, an evaluation of effects due to changes in product and factor prices and determination of proportionate share of the Federal tax burden will be required to provide a complete description of regional income redistributive impacts of water transfers. (See W69-09210). (Sherbrooke-Ariz)
W69-09224

PERCEPTION OF CHOICE AND FACTORS AFFECTING INDUSTRIAL WATER SUPPLY DECISIONS IN NORTHEASTERN ILLINOIS,
Chicago Univ., Ill. Dept. of Geography.
For primary bibliographic entry see Field 03E.
W69-09322

IS PUBLIC INTERVENTION IN WATER RESOURCE DEVELOPMENT CONDUCIVE TO ECONOMIC EFFICIENCY,
John V. Krutilla.
Natural Resources Journal, Vol 6, No 1, p 60-75, Jan 1966. 16 p, 1 tab.

Descriptors: *Economic efficiency, Welfare (Economics), Water resources development, Cost-benefit analysis, Administrative agencies, History.
Identifiers: Income redistribution, Research needs.

The paper reviews the history of propositions in welfare economics which have become firmly established in concept and practice. It raises questions regarding their applicability at this stage in the development of water resources. Public intervention, while necessary, may not be sufficient to improve efficiency in government agencies. Benefit-cost analysis is supposed to provide criteria by which intervention can improve efficiency. However, benefits are typically overstated by the benefit-cost calculation. Income redistribution attending a project should be considered in terms of efficiency but traditionally has not been. The efficiency of the institutional mechanism of public intervention is analyzed. The more established an agency is, the more traditional its goals and approaches are likely to be. A community's growing needs may surpass the capability of its agencies. Pressing research needs include a review of the capabilities of existing agencies, identification of the barriers to improved performance, and consideration of the problem of organizing a capability consonant with present and future needs. Models for study include the cooperative water quality management associations in the Ruhr and the integration of investment planning, design criteria and pricing policy of Electricite de France. (Gossen-Chicago)
W69-09323

WATERCOURSES--RECREATIONAL USES FOR WATER UNDER PRIOR APPROPRIATION LAW,
For primary bibliographic entry see Field 06E.
W69-09324

MUNICIPAL WATER SUPPLY AND RECREATION: ARE THEY COMPATIBLE,
Colorado Univ., Boulder.
Ralph A. Graham.
Water Development Utilization, Conservation, 5th Western Resources Conference, Boulder, Colo, p 31-35, 1963. 5 p.

Descriptors: *Multiple-purpose reservoirs, *Recreation, Water quality, Water supply.
Identifiers: *Community relations, *Citizen's advisory groups.

In response to the question posed, the case of San Diego, California is cited as an example of a situation where the two uses have been found to be compatible. The author admits, however, to the possibility of this not being true in other jurisdictions. The present reservoir recreation program in San Diego utilizes each of the two impounding reservoirs in the city's reservoir system. Activities include fishing, waterfowl hunting, picnicking, hiking and camping but water contact activities such as swimming, wading and water skiing are prohibited. A program involving such an important part of the community as its water supply reservoirs has many community relation problems. The City of San Diego has taken a three facet approach to solving these problems: (1) appointment of an advisory group of respected citizens to a City Lakes Recreation Commission; (2) appointment of a specialist in fish and game matters to the city's utilities department staff; and (3) hard work on the part of everyone from the city manager down to the newest laborer to insure a successful reservoir recreation program. This includes maintaining a good relationship with all of the news media and maintaining good public relations with all the public agencies and citizen's organizations. (Starr-Chicago)
W69-09328

OPTIMIZING INVESTMENT IN FLOOD CONTROL AND FLOOD PLAIN ZONING,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 06F.
W69-09330

DEVELOPMENT OF RECREATIONAL AND RELATED RESOURCES AT HYDROELECTRIC PROJECTS LICENSED BY THE FEDERAL POWER COMMISSION,
Sherman S. Poland.
Land and Water L Rev, Vol 4, No 2, p 375-398, 1969. 24 p, 94 ref.

Descriptors: *Water resources development, *Federal Power Act, *Hydroelectric project licensing, *Conservation, Recreation, Administrative agencies, Hydroelectric plants, Multiple-purpose projects, Fish conservation, Wildlife conservation, Federal project policy, Project planning, Regulation, Water Resources Planning Act, Legal aspects, Scenery, Transmission lines, Heated water, River basin, Development, Thermal pollution, Permits.
Identifiers: *Federal Power Commission, Licenses, Licensing.

The purpose of this article is to explore the scope and exercise of the Federal Power Commission's authority when licensing hydroelectric projects, to assist development of related water resources and to foster conservation measures. The Federal Power Commission is authorized by Congress to license all hydroelectric projects to assure comprehensive development of the water resources. The licensing was used first to protect navigation but then extended to projects on private water

nder the rationale of interstate trade in electric power. The importance of the licensing power is he requirement that projects plan for comprehenive development including recreation and conservation. At first the Commission's policy in aid of ecreation at project sites depended on the particular situation. Now with the Water Resources Planning Act of 1965 the Commission submits applications for hydroelectric licenses to the Water Resources Council. The Council reviews water and and resource policies of federal agencies with an emphasis on conservation and recreation. Besides ubmission of license to the Water Resources Council the Commission requires comprehensive plans for development of recreation for conservation of natural resources around the hydroelectric ites. If the hydroelectric planning does not appear o be in the public's interest in development of ecreation, conservation of natural resources or protection of historical sites there is precedent for efusal of license applications. (Gadd-Fla)
W69-09376

NORTHEASTERN WATER AND RELATED LAND RESOURCES COMPACT.

NH Rev Stat Ann secs 489-A:1 thru 489-A:4 (1968).

Descriptors: *New Hampshire, *Interstate commissions, *Water resources development, *Project planning, Legislation, New England, Planning, Administrative agencies, Regulation, Water policy, Administrative costs, Coordination, Federal government, State governments, Maine, Connecticut, Rhode Island, Vermont, Massachusetts, Interstate compacts, Governors, Financing.
Identifiers: *Northeastern Resources Commission, *Northeastern Water and Related Land Resources Compact.

The governor has the authority to enter into a compact with the other New England states to encourage coordination among its members in formulating recommendations for the solution of problems in the field of water and related land resources. The compact is also to encourage cooperation with United States agencies. The Northeastern Resources Commission is the body set up to carry out the purposes of the compact. Each state and the agencies and departments of the federal government involved in water and land resources shall select one person to represent them on t he Commission. The Commission shall make recommendations to each member state and the federal government. The Commission shall: collect and interpret pertinent data; investigate and plan water and related land resources projects; program the construction of these projects; and encourage the referral of projects to the Commission. No action of the Commission shall be binding unless taken at a meeting in which a majority of members are present. The Commission is to be financed by appropriations from each member state and the federal government. The Commission may sue or be sued and may hire personnel necessary to carrying out its duties. This compact shall not impair any other compact already entered. The compact becomes effective upon t he entry of three other states and the appointment of the federal representation. A member may withdraw after three years notice. (Gadd-Fla)
W69-09395

DELAWARE WATER AND AIR RESOURCES COMM'N.

Del Code Ann tit 7, secs 6002-6016 (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Jurisdiction, *Natural resources, Legislation, Water law, Administration, Water policy, Legal aspects, Federal government, Water resources development, Regulation, Judicial decisions, Permits, Financing, Adjudication procedure, Government finance.
Identifiers: Penalties (Criminal).

The Delaware Water and Air Resources Commission conducts proceedings against violations of the water and air conservation laws of this section and holds public hearings with respect to granting permits, leases and grants authorized by this section. Appeal to the superior court of decisions substantially affecting any person may be had only after prior notification of the commission. Fines are provided and may be assessed against violators of this provision on a per diem basis with each day of continued violation considered a separate offense. The commission may cooperate with and receive moneys from the federal government or any industry or other source. (Johnson-Fla)
W69-09396

BROADWAY LAKE COMM'N, ANDERSON COUNTY.

SC Code Ann, secs 51-211 thru 51-216, 51-218, 51-221, 51-223, 51-225, 51-226, 51-236 (1962).

Descriptors: *South Carolina, *Administrative agencies, *Water policy, *Water resources development, Legislation, Legal aspects, Regulation, Administration, Local governments, Permits, Fishing, Water resources, Resource development, Conservation, Multiple-purpose projects, Riparian rights, Lakes, Recreation, Recreation facilities, Fishing gear.

The Broadway Lake Commission manages and controls Broadway Lake in Anderson County and those park areas in and near said lake. The Commission, with the aid of the county supervisor, sees to the proper improvement, maintenance and supervision of the lake area and also makes rules and regulations necessary to carry out these duties. The Commission may condemn, purchase, lease or otherwise acquire such properties as are needed to create the lake and adjacent park areas. Boathouses and walks built with Commission approval are exceptions to the general prohibition of private building on the lake edge. Fishing is governed by state law and may be done only by hook, pole, line and hook or rod, reel, line and hook. Artificial lights may not be used by fishermen to attract fish. The sheriff and his deputies in Anderson County in cooperation with the lake patrolman are responsible for keeping order around said lake. (Johnson-Fla)
W69-09401

GREAT LAKES BASIN COMPACT.
Ill Ann Stat ch 127, secs 192.1 - 192.4 (Smith-Hurd 1967).

Descriptors: *Illinois, *Great Lakes region, *Interstate compacts, *Water resources development, Legislation, Interstate commissions, Great Lakes, Indiana, Michigan, Minnesota, New York, Pennsylvania, Ohio, Wisconsin, Legal aspects, Navigation, Regulation, Project planning, Conservation, Recreation, Watersheds (Basins), Water management (Applied), Watershed management, Water utilization, Administrative agencies.
Identifiers: *Great Lakes Basin Compact.

The State of Illinois does hereby ratify, approve and adopt the Great Lakes Basin Compact. The purposes of the compact include: (1) the development, use and conservation of the water resources of the Great Lakes Basin; and (2) the securing and maintaining of a proper balance among industrial, commercial, agricultural, water supply, recreational and other legitimate uses of the water resources of the basin. The compact shall be effective when enacted by any four of the participating states. A Great Lakes Commission is hereby created and shall perform enumerated powers within the Great Lakes area and any watercourse or watershed draining in any of these lakes. The Commission shall have, among its other powers, the power to: (1) correlate data relating to water resources; (2) recommend methods for developing and conserving water resources; (3) consider means of improving navigation and fisheries; (4) recommend policies relating to water resources including institution and alteration of flood plains; and (5) recommend to the party states uniform and other laws relating to the basin's water resources. Each party state agrees to consider the action the Commission recommends. Ratification and approval procedures are also provided. (Heckerling-Fla)
W69-09442

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

AN EFFICIENT PROGRAM OF WATER RESOURCE DEVELOPMENT IN A FRAMEWORK OF GROWTH AND TRADE,
California Univ., Berkeley; and Resources for the Future, Inc., Washington, D.C.
For primary bibliographic entry see Field 06A.
W69-09362

OPTIMIZATION OF LONG-RANGE MUNICIPAL MULTI-RESOURCE FISCAL POLICIES,
Service Bureau Corp., Inglewood, Calif.
Charles B. Woodward.
Soc Econ Planning Sci, Vol 1, No 3, p 273-282, July 1968. 10 p, 1 tab, 5 fig.

Descriptors: *Linear programming, *Metropolitan Water Dist. of So. Calif., *Optimization, *Water distribution (Applied), *Water rates, Model studies, Financial analysis, Computers, Budgeting, Interest rate, Investment.

A linear programming model was developed to assist the Metropolitan Water District of Southern California (MWD) in determining the cost of the various fiscal policies. A linear programming matrix using raw data was produced by a matrix generator. The linear programming output was translated by another computer program into budget reports to the board of directors. Two types of input data were required, (a) monetary data of current tax rates and fixed expenditure and receipts, maximum tax water rates, bond interest rates, interest rates earned on investments, and (b) model data consisting of periods, row names, vector names and fixed coefficients. Three studies were made for the MWD and two separate objective functions, minimization of cost to the citizen and minimization of total bond interest cost, were examined. Although the maximum tax rate was unacceptably high, the results obtained for minimizing total tax and water revenues were illuminating. The use of computers facilitated the task. (Thiuri-Cornell)
W69-09363

A MATHEMATICAL THEORY OF COST-EFFECTIVENESS,
INFRET Corp., New York.
Herman Zabronsky.
Soc Econ Planning Sci, Vol 1, No 1, p 3-18, Sept 1967. 16 p, 7 fig, 4 ref.

Descriptors: *Mathematical models, *Cost-benefit analysis, *Budgeting, *Planning, *Optinization, Resource allocation, Decision making, Input-output analysis.
Identifiers: Cost-effectiveness, Gradient Method.

A rigorous mathematical theory of cost-effectiveness, based on Gradient Method, was developed that was applied to obtain quantitative solutions to decision making problems. The problems pertained to planning, programming and budgeting systems that require precise comparison of alternate plans and programs. Cost-effectiveness analysis was used to make such comparisons by relating resource input and useful output of a program relative to stated planning goals. The proper applications of cost-effectiveness depended on their mathematical foundations. (Thiuri-Cornell)
W69-09366

RICE V OAKLAND COUNTY DRAIN COMM'R (ASSESSMENTS MUST BEAR RELATIONSHIP TO BENEFITS).

168 NW 2d 302-304 (Ct App Mich 1969).

Descriptors: *Michigan, *Assessments, *Benefits, *Property values, Appraisals, Evaluations, Condemnation, Compensation, Lakes, Riparian land, Judicial decisions, Legal aspects, Remedies, Water levels, Real property, Administrative agencies, Administrative decisions, Adjudication procedure.

A special assessment district was established in 1963 to fix and maintain the water level of Lower Straits Lake. The original assessment made by defendant commissioner on plaintiffs' land was $2,264.75. As the result of a petition by plaintiffs, a board of review revised this special assessment at a reduced sum of $1,265. Plaintiffs appealed to the circuit court. That court found the revised assessment to be equitable and reasonable under the circumstances. From this decision plaintiffs appealed, contending that the stabilization of the water level of the lake did not increase the value of their property since special soil conditions made the property unsuitable for the construction of buildings and residences. The court affirmed the circuit court's decision. The court agreed that an assessment to be valid must relate to the benefit which reasonably applies to the subject property. It found evidence that the board of review had taken into account the special soil conditions in revising the assessment. The court found insufficient evidence to negate the conclusion that the revised assessment accurately reflected the equitable benefit derived by the plaintiffs from the stabilization of the lake water level. (Gabrielson-Fla)
W69-09408

IMPERIAL REFINERIES OF MINNESOTA INC V CITY OF ROCHESTER (ASSESSMENT FOR SEWER AND WATER IMPROVEMENTS).
165 NW 2d 699-703 (Minn 1969).

Descriptors: *Minnesota, *Assessments, *Sewers, Judicial decisions, Conduits, Project benefits, Cities, Water tanks, Legal aspects, Local governments, Evaluation, Taxes.
Identifiers: Water mains.

Defendant city assessed plaintiff's property for sewer and water improvements. Plaintiff appealed claiming that the failure of defendant to give notice of the final assessment made the assessment unconstitutional. Plaintiff also claimed that the city is estopped from denying that it proceeded under a repealed statute since such statute was erroneously designated by the city clerk. Finally, the plaintiff claimed that the assessments were improperly allocated. The court found for the defendant. The court decided the first contention had no merit since plaintiff's full participation in previous proceedings was sufficient notice. Even without sufficient notice, plaintiff's full hearing on the merits was held to be a waiver of any objection. Plaintiff's failure to rely on the erroneous designation was held to invalidate his second contention. The third contention was held to be without merit since the alleged improper allocation was in fact due to dissimilar benefits. In addition, property given a lower assessment was outside the city and its owners had assumed the assessment. (Gadd-Fla)
W69-09412

6D. Water Demand

DETERMINANTS OF PROPERTY VALUE ON ARTIFICIAL LAKES,
E. L. David, and W. B. Lord.
University of Wisconsin, Dept of Agricultural Economics, No 54, May 1969. 55 p, 12 ref.

Descriptors: *Water allocation (Policy), *Water resources development, *Recreation demand, *Artificial watercourses, Property values, Lakes, Watercourses (Legal), Value, Market value, Shores, Lake shores, Riparian land, Recreation, Wisconsin, Resources development, Resource allocation, Water demand, Water values, Access routes, Topography, Water pollution, Population, Density, Surface waters.

The public demand for water recreation areas, as measured by examining the market values of waterfront property is used as an aid to guide future water resource development. The accuracy of such a study is somewhat limited in that it only registers the demand of that segment of the population which can afford to purchase waterfront property. The authors explain the criteria for choosing the sample and for determining the property values. The patterns of the rising demand for riparian land are examined. A statistical analysis of the effect of factors influencing development is presented including an examination of land value, value of improvements, number of improvements per acre, topography, ease of access, pollution, proximity to population centers, amount of surface water in vicinity, and amount of privately owned shoreline. The data presented is summarized and conclusions are drawn. (Gabrielson-Fla)
W69-09065

WATER USE IN THE MINERAL INDUSTRY,
Bureau of Mines, Washington, D.C. Div. of Economic Analysis.
Alvin Kaufman, and Mildred Nadler.
Bur Mines Inform Circ No 8285, 1966. 58 p, 15 fig, 24 tab, 8 ref, 2 append.

Descriptors: *Water utilization, *Mineral industry, Mining, Sands, Gravels, Iron, Phosphates, Reclaimed water, Water reuse, Waste water treatment.
Identifiers: Mineral industry water use.

To aid industry and Government in planning water developments the Bureau of Mines in 1963 canvassed mineral producers to determine water use in 1962. Water used by the mineral industry is only 2% of the water withdrawn by all industry. The major water-using mineral industries are natural gas processing, phosphate rock, sand and gravel, and iron ore. Total water use and new water intake is dependent on the quantity of material processed and the process water requirements of the particular industry or commodity. Recirculation is dependent on the processing requirements of the particular commodity, the manner in which the water is used, cooling and condensing requirements in large industries, the quality of new water intake, and the need to treat new discharged water. Consumed water is dependent on the quantity of water recirculated, the temperature and humidity in the area, and the proportion of water used for cooling and condensing. A threefold increase in water use by the mineral industry by 1985 is forecast. (Knapp-USGS)
W69-09201

PANEL DISCUSSION-INTRODUCTORY REMARKS,
Water Resources Council, Washington, D.C.
Henry P. Caulfield, Jr.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 406-411, University of Arizona Press, Tucson, 1969. 6 p, 10 fig.

Descriptors: *Water resources planning, Human population, Economy, Long-term planning, Decision making, Administration.
Identifiers: Federal-state planning, *First National Assessment of the Nation's Water Resources, *Water Resources Council.

The paper presents background information relating to the First National Assessment of the Nation's Water Resources by the Water Resources Council and to the Federal-State comprehensive framework planning program underway and projected for the U.S. under the aegis of the Water Resources Council. Long-term projections, used as guidelines for public programs, reflect the fact that the Nation has no policy or plan at the present time to slow down or stabilize either population or economic growth. Need for such a policy or plan in response to concern with human ecology possibly should be the subject of widespread national discussion and of official concern. Until such a policy is formulated and implemented, responsible public planning within a functional area must be based upon what appears to be future reality under established policies, mores, and conditions. The council adopted 20 major river basins and regions for study, major topics considered are listed and programs in progress are outlined. 17 topics on which express findings and recommendations were given are listed, one of which agricultural water management policy, has been recommended for a special national study. The Council's comprehensive planning program is clearly laying a foundation for analysis of large scale transfer needs, if any. (See W69-09210). (Sherbrooke-Ariz)
W69-09222

HYDROGEOLOGICAL STUDIES FOR DRINKING WATER SUPPLY OF CRAIOVA CITY (ROMANIAN),
For primary bibliographic entry see Field 04B.
W69-09287

WATER REQUIREMENTS AND USES IN WYOMING MINERAL INDUSTRIES,
Bureau of Mines, Denver, Colo. Dept. of Engineering.
Millard M. Gilkey, and Ronald B. Stotelmeyer.
Bur of Mines Inform Circ No 8328, 1967. 92 p, 44 fig, 4 tab, 18 ref, 1 append.

Descriptors: *Water utilization, *Water requirements, *Mineral industry, *Wyoming, Data collections, Water reuse, Reclaimed water, Surface waters, Waste water treatment, Water law.
Identifiers: Mineral industry water requirements.

A detailed study was made of water usage in the Wyoming mineral industry, with projections for the future. In 1964, the mineral industries of Wyoming used 20 billion gal. of new water, nearly all self-supplied, and reused 72 billion gal, a total usage of 92 billion gal. Consumption amounted to 2.8 billion gal. About half of the 20 billion gal of new water was obtained from surface sources and the rest from groundwater. Reported costs, covering power and maintenance, for the self-supplied new water at mineral industry operations ranged from about 1 to 20 cents per thousand gal and averaged 8 cents. Cost of recirculation of water, including power and maintenance, averaged 2 cents. The value of product for the entire industry was $25 per thousand gal of new water intake and about $180 per thousand gal consumed. Wyoming has a water deficiency but the shortage is less severe than in the arid Southwest. The demand for new water will increase from the 20 billion gal used in 1964 to 25 billion gal in 1980. The projected new-water requirement for the year 2000 is 40 billion gal. (Knapp-USGS)
W69-09294

WATER TRANSFERS.
Washington Univ., Seattle.
Frank Quinn.
Geographical Review, Vol 58, No 1, p 108-132, Jan 1968. 25 p, 3 fig, 4 tab, 87 ref.

Descriptors: *Water transfer, *Water demand, Legal aspects, Political constraints, Water rights, Municipal water, Industrial water, Competing uses, Water supply, History.

The paper has two objectives: (1) to develop some perspective on water transfers relative to the growth of total, and urban, demands in the West and on alternative means for satisfying them; and (2) to discuss the range of legal and political impediments that bear on the flow of water among different users and regions. The evolution of competitive demand for water rights is traced; historically and currently, a municipal-industrial water

supply has low priority. Legal and political restrictions on the transfer of existing water rights make it difficult for growing cities to purchase agricultural water supplies. States have adopted a 'hands off' policy on transferring water to other states. Negative aspects of water transfer are summarized, but legal and political accommodations to transfer are recommended. Extensive research on alternative solutions to the water crisis should be undertaken. (Gossen-Chicago)
W69-09325

6E. Water Law and Institutions

WATER PLANNING FOR NORTH AMERICA,
American Bar Association, Chicago, Ill. Section of Minerals and Natural Resources Law.
Maxwell Cohen.
ABA Section of Mineral and Natural Resources Law (1966 Proceedings), p 21-26, 1966. 6 p.

Descriptors: *International law, *Boundaries (Surfaces), *International Joint Commission, *River basins, Legal aspects, Disalination, Columbia River basin, Navigable waters, Non-navigable waters, Treaties, Planning.
Identifiers: North America.

The author discusses the approaches used by various countries for handling the problems of multinational river boundaries. He touches on the systems used by other nations and on the situation as it exists between the United States and Canada. He states that in the area of cooperative non-navigational uses the United States-Canada experience has become a model to be studied by Europeans. He considers the boundary waters experience between these two nations as having been highly successful. The author fully develops the history of United States-Canada relations in this area and theorizes that resort to the international tribunals would not have produced such success. He feels that these nations have progressed to a point where there is recognition of sharing a common continent and the water programs of these nations have done much in that direction. The full ramifications of this continentalism have not yet developed, but, when they do, there should be even more substantial continentalist policies. (Shevin-Fla)
W69-09059

COMMONWEALTH V NEW YORK AND PENNSYLVANIA CO. (EQUITABLE RELIEF FROM STREAM POLLUTION).
For primary bibliographic entry see Field 05G.
W69-09060

SIZING UP ANTI-POLLUTION LEGISLATION,
For primary bibliographic entry see Field 05G.
W69-09061

AIR POLLUTION, WATER POLLUTION, INDUSTRIAL COOPERATION AND THE ANTITRUST LAWS,
For primary bibliographic entry see Field 05G.
W69-09062

VIAN V SHEFFIELD BLDG. AND DEV. CO. (SUIT TO ENJOIN DISCHARGE OF SEWAGE).
For primary bibliographic entry see Field 05G.
W69-09064

DETERMINANTS OF PROPERTY VALUE ON ARTIFICIAL LAKES,
For primary bibliographic entry see Field 06D.
W69-09065

COMMONWEALTH V TEMPLE COAL CO. (CONSTRUCTION OF SETTLING BASIN PURSUANT TO BOARD ORDER).

76 District and County Reports 7-25 (CP Pa 1949).

Descriptors: *Pennsylvania, *Flood control, *Streamflow, *Obstruction to flow, Judicial decisions, Settling basins, Desilting, Erosion control, Flow control, Streams, Stream erosion, Flooding, Riparian land, Riparian waters, Legislation, Banks, Bank erosion, Coal mine wastes, Mineral industry, Administrative agencies, Cost allocation.
Identifiers: Culm piles.

Plaintiff coal company owned land through which a stream flowed. Erosion of culm piles on the banks of the stream resulting from heavy rain and flooding caused ensilting in the stream and obstruction of water flow. Under an act making it unlawful to construct an obstruction so as to change the flow of a stream, the water board issued an order requiring the company to construct a settling basin on the stream to intercept flood wash and debris. The company built the settling basin and attempted to force contri bution for costs from an adjacent coal company. The court held that the act did not empower the board to direct a riparian owner to construct any work in any stream or upon his land to prevent flooding. The board's only power was to direct removal of the obstruction. The company that built the settling basin was therefore a volunteer in its actions and could not compel contribution from the other company. (Helwig-Fla)
W69-09066

HOLDERS OF NEW YORK FISHING LICENSES; FISHING IN NEW JERSEY PART OF GREENWOOD LAKE.

N J Stat Ann sec 23:9-126 (Supp 1968).

Descriptors: *New Jersey, *Permits, *Fishing, *Interstate, Bodies of water, Legislation, Equitable apportionment, Water policy, Wildlife conservation, Boundaries (Property), Lakes, Water rights, New York, Legal aspects.
Identifiers: Licenses.

This section exempts citizens of New York who hold New York fishing licenses from the general requirement that everyone who fishes in New Jersey waters must hold a New Jersey license. The exemption applies only to that part of Greenwood Lake which lies in New Jersey and is conditioned with the proviso that the section shall apply only if New York exempts those holding New Jersey licenses when such individuals fish the New York portion of Greenwood Lake. (Blunt-Fla)
W69-09067

ELKHORN COAL CORP. V YONTS (SUIT AGAINST MINERAL OWNER FOR ALLEGED DAMAGE TO WATER WELL).

262 SW 2d 384-385 (Ky 1953).

Descriptors: *Kentucky, *Mining, *Water wells, *Subsurface waters, Deep wells, Underground, Coal mines, Mining engineering, Mineralogy, Salts, Mineral water, Domestic water, Judicial decisions, Legal aspects, Civil law.

Plaintiff landowner brought suit against mineral owner for alleged damages to a water well. Plaintiff claimed that the wrongful mining operations of defendant had caused his well to go dry. On appeal the defendant contended that (1) his mineral deed gave him the right to subterranean waters; and (2) for plaintiff to sustain his claim he had to show that the mining operation was done in wanton and malicious disregard of his surface rights. The court disallowed defendant's first point by ruling that the deed which used the terms 'mineral' and 'all salt mineral waters' was not broad enough to include subterranean waters. As to defendant's second contention, the court reasoned that where at least two-thirds of the coal was left unmined, where there were no breaks in the mine roof or water leaks under the well, and where there were no cracks or cave-ins on the surface, the mineral owner was not liable for the drying up of the water well. The lower court was thus reversed because of the lack of proof showing any grossly negligent or wanton and malicious actions by defendant. (Logan-Fla)
W69-09068

COMMONWEALTH V GORHAM (SUIT TO COMPEL LAND OWNER TO REINSTATE DRAINAGE SYSTEM).
For primary bibliographic entry see Field 04A.
W69-09069

STIGALL V SHARKEY COUNTY (SUIT TO DETERMINE JURISDICTION OVER HIGHWAY WHICH HAD CAUSED FLOODING).
For primary bibliographic entry see Field 04C.
W69-09070

KIDDE MANUFACTURING CO V TOWN OF BLOOMFIELD (DAMAGES RESULTING FROM STREAM IMPROVEMENTS).
20 NJ 52, 118 A 2d 535-543 (1955).

Descriptors: *New Jersey, *Stream erosion, *Flow augmentation, *Channel improvement, Banks, Bank erosion, Channel erosion, Streambeds, Cities, Stream stabilization, Natural flow, Downstream, Retaining walls, Flood control, Damages, Riparian land, Velocity, Streamflow, Judicial decisions, Construction.

Plaintiff brought this suit to recover damages caused to his property by the acceleration of the flow of water in a certain stream. Plaintiff was riparian land owner on this stream which flowed between the two defendant municipalities. As part of a flood control program defendants constructed concrete walls on the banks and concrete floor on the bed of the stream above and below plaintiff's property. This construction did not include that segment of the stream flowing through plaintiff's property. As a result of erosion of silt and gravel, a wall on plaintiff's land collapsed and a building was damaged. Plaintiff alleged the increase in stream velocity resulting from the improvements caused the erosion and resulting damages. Defendants contended that the erosion was caused by plaintiff's removal of a dam and other stabilizing elements in the stream. From a judgment for defendants, plaintiff appealed. The court held that if the cities knew or should have known that the improvements would so increase the velocity of flow as to cause erosion and damage, and took no steps to avoid that result, they would be liable for the damages. The evidence, however, supported a finding that the cities had exercised reasonable care to avoid damage to plaintiff and that the injuries complained of were the result of plaintiff's own action. (Helwig-Fla)
W69-09071

CHANGING LAW FOR THE CHANGING SEAS,
Columbia Univ., New York.
Louis Henkin.
Uses of the Seas, p 69-97, (E Gullion ed 1968) 29 p, 1 fig.

Descriptors: *Law of the sea, *Oceans, *International law, *International waters, Commercial fishing, Foreign trade, Treaties, Legal aspects, Federal government, Admiralty, Navigation, Military aspects, Water law, United Nations, Continental shelf, Mining, Coasts, Boundaries (Surfaces), Exploitation, International hydrological decade.
Identifiers: *Contiguous zones, *Territorial sea.

Expanded use of the sea and its resources necessitate more enlightened thinking regarding the law of the sea and legal arrangements concerning it. The basic principle of the law of the sea is freedom. This principle and its limitations apply to the sea, the air, and the ocean floor. Coastal states have historical rights in their territorial sea, fishing zones, contiguous zones and continental shelf. Conflicting uses of the sea have forced the development of preferred and reasonable uses of the ocean area as well as international agreements. Issues and problems result from the uncertainties and inadequacies in the law. For example, the continental

shelf, as defined by international convention, is outdated by modern technology. Alternatives have been suggested. Proposals have been made for a new law of the sea as it should apply to military use, scientific research, fishing and mineral resources mining. Advantages may be found in United Nations' control of the sea and in an international authority to govern the seas. (Helwig-Fla)
W69-09072

LAND AND WATER CONSERVATION FUND ACT AMENDMENTS.

Hearing on HR8578 and related bills before the subcomm on National Parks and Recreation of the House Comm on Interior and Insular Affairs, 90th Cong, 2d sess, ser 90-20 (1968).

Descriptors: *United States, *Legislation, *Recreation facilities, *Water conservation, Leases, Federal governments, State governments, Local governments, Recreation, Water resources development, Real property, Resource development, Contracts, Parks, Financing, Land management.
Identifiers: *Land and Water Conservation Fund Act.

The Subcommittee on National Parks and Recreation of the Committee on Interior and Insular Affairs of the House of Representatives met to consider a bill to amend title I of the Land and Water Conservation Fund Act of 1965 and other bills to amend the Land and Water Conservation Fund Act of 1965. The bill amending title I would: (1) add for a limited time additional sources of revenue to the Fund for Federal and state property acquisition; (2) authorize the head of the department concerned to contract, under certain restrictions, for the acquisition of property in advance of the actual appropriation of funds; and (3) authorize a lease-back and sell-back land management program for property acquired by the National Park system with moneys so received being credited to the Fund. The other bills would provide only for increased revenues to the Fund in order to assist federal, state, and local governments in acquiring and developing public outdoor recreation facilities. The committee heard arguments from both sides on the passage of the bill and considered numerous statistics and letters from interested parties. (Heckerling-Fla)
W69-09073

DEPARTMENT OF CONSERVATION.

Minn Stat, secs 84.024 to 84.032, 84.081 to 84.111, 84.14 to 84.154 (1967), as amended, (Supp 1969).

Descriptors: *Minnesota, *Administrative agencies, *Conservation, *Project planning, Legislation, Obstruction to flow, Administration, Legal aspects, Low water mark, Water law, State governments, Boat launching ramps, Boats, Recreation facilities, Boating regulations, Fish conservation, Aquatic plants, United States, Public rights, Land tenure, Financing, Access routes, Projects.
Identifiers: *Injunctions (Prohibitory).

The creation and organization of a department of conservation is provided in this chapter. The commissioner of conservation is vested with prescribed powers and duties with respect to public lands, timber, water and minerals of the state, and records pertaining thereto. Specific responsibilities include boat safety, game and fish conservation, and recreational land project planning, including regulation of public access and boat launching facilities. The commissioner may sue to enjoin an obstruction to waterflow outside the state which affects the state. In civil actions involving navigability or ownership of beds to which the state is a party, the commissioner may stipulate the low water mark involved. The department shall have a division of waters, soils and minerals. The commissioner shall be responsible for state water projects and the sale or acquisition of land for such purposes. A Lac qui Parle and Big Stone Lake Water Control Projects Fund is hereby established. (Harris-Fla)
W69-09074

BRIDGES.

Minn Stat, secs 165.01 to 165.12 (1960).

Descriptors: *Minnesota, *Bridge construction, *Bridge design, *Interstate rivers, Navigable waters, Legislation, Interstate compacts, Disasters, Floods, Bridges, Mississippi River, Federal jurisdiction, Financing, Legal aspects, Local governments, Interstate, Maintenance, Operation and maintenance, Highways, Administrative agencies.
Identifiers: *Toll bridges, *Bridge specifications, Minnesota River, *Draw bridges.

Road authorities may construct and maintain bridges as necessary. All bridges shall be of minimum specified strength and of specified width if constructed subsequent to this act. Bridges of less than minimum width may be repaired or constructed under certain circumstances. The width and grade of approaches to bridges shall be as specified unless modified by the commissioner. To connect highway systems of adjoining states with this state, the road authority may acquire interstate bridges belonging to other states or private persons, and cooperate with other states in construction and maintenance of bridges. Where Congress has authorized bridges over waters between this state and an adjoining nation, the commissioner may cooperate with foreign authorities for bridge construction and maintenance of free or toll bridges. Tolls shall be collected as provided. Local governmental units may acquire bridges over navigable streams if they are 'interested' as prescribed by this act. Bridges over navigable waters or the Minnesota or Mississippi River shall be subject to special approval. All draws shall be opened on reasonable signal. Town bridges destroyed by flood or calamity shall be reconstructed as provided, and financed according to the act. (Harris-Fla)
W69-09075

ROADS, GENERAL PROVISIONS.

Minn Stat Ann secs 160.06, 160.19, 160.20, 160.201 (1960), as amended (Supp 1968).

Descriptors: *Minnesota, *Highways, *Roads, *Drainage, Embankments, Road banks, Transportation, Road construction, Right-of-way, Drains, Ditches, Railroads, Legislation, State governments, Construction, Permits, Legal aspects, Maintenance.

Any forest trail or portage between navigable waterbodies or from navigable waterbodies to a public highway which has been in continuous use for 15 years or more as a trail shall be deemed to have been dedicated to the public. When a road authority constructs a drainage ditch to drain a highway and the ditch crosses a railroad right-of-way, the railroad shall carry the ditch across the right-of-way. The costs shall be apportioned on the basis of benefits to each. The owner of land which drains naturally to a highway may enter the highway to connect his drain to any drain constructed along or across the highway provided he obtains a written permit from the road authority. Anyone desiring to install a drain for agricultural purposes in a natural drain on a highway being constructed, must do so while the highway is being constructed. For the purpose of draining public roads and preventing large accumulations of water in road ditches, the authorities having supervision over the roads may have the ditches cleaned or improved in order to provide proper drainage. (Helwig-Fla)
W69-09076

SUPERVISION OF DAMS AND RESERVOIRS.
Conn Gen Stat Ann secs 25-110 to 25-119 (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Supervisory control (Power), *Dams, *Reservoirs, Legislation, Dam construction, Design, Water law, Legal aspects, Inspection, Permits, Administration, Safety, Administrative agencies, Control, Regulation.
Identifiers: Penalties.

The Water Resources Commission in its jurisdiction over all dams, has the power to formulate rules, delegate authority, enter private property, and to consult experts necessary to carry out the provisions of this chapter. The commission inspects dams which they deem unsafe and, if found to be unsafe, they may require owners to either make them safe or to remove them. The owners may then be required to make periodic inspections. The commission must issue a permit for any dam to be constructed. All dams, while under construction, shall be inspected by the commission to determine whether they will be safe and secure. If this inspection is passed, the commission shall issue a certificate of approval to the dam owner. No order, approval or advice by the commission shall act to relieve any dam owner from liability resulting from ownership or operation. Violation of any provision of this chapter or order of the commission is punishable by a fine of $500 a day. Any person aggrieved by a decision of the commission is entitled to a hearing before the commission and an appeal to the superior court. (Holt-Fla)
W69-09077

ALL HE WANTS TO DO IS SAVE THE WORLD,
For primary bibliographic entry see Field 05G.
W69-09078

FISH AND FISHERIES.

Md Ann Code art 66C secs 234 thru 237, 245 thru 248, 250, 251, 252A, 253 (1957).

Descriptors: *Maryland, *Tidal waters, *Wildlife, *Fisheries, Anadromous fish, Commercial fish, Herrings, Fish barriers, Fish food organisms, Fish hatcheries, Fish migration, Fish passages, Fish stocking, Dams, Nets, Fish handling facilities, Administrative agencies, Boats, Streams, Riparian rights, Recreation, Explosives, Natural resources, Creeks, Legislation, Regulation, Civil law, Fish conservation.
Identifiers: Chesapeake Bay.

All laws respecting the regulation of size and sale of fish shall apply to those caught in the waters of the state or those caught outside the state and brought into it. The Tidewater and Inland Fishing Commissions shall inspect the waters of the state and may erect and maintain hatcheries where suitable. It is unlawful to place obstructions at the mouth of any stream or cove which would prevent the fish therein from having free passage. All dams must contain at least one fish ladder suitable for allowing fish to have a free course up and down at all times. It shall be unlawful to use dynamite in any streams except for bona fide engineering, milling, or mining purposes. It shall be unlawful to thresh streams for the purpose of driving fish into nets. No boat shall be anchored in any fishery during the herring season. Any boat sailing through a net lawfully placed in the waters shall be guilty of a misdemeanor and liable for the damages it causes. Riparian owners have first rights to conduct a commercial fishery in the waters in front of their property. (Shevin-Fla)
W69-09079

ATLANTIC STATES MARINE FISHERIES COMPACT.

Md Ann Code art 66C secs 256 thru 261 (1957).

Descriptors: *Maryland, *Interstate compacts, *Marine fisheries, *Atlantic Ocean, Shellfish, Anadromous fish, Marine fish, Commercial fishing, Sport fishing, Regulation, Legislation, Administrative agencies, Fish conservation, Fisheries, Fishing, Fish management, Interstate commissions, Governors.

The provisions of the Atlantic State Marine Fisheries Compact are set out. The purpose of the compact is to promote better use of Atlantic seaboard fisheries through development of a joint program. The compact will become effective whenever two of the listed Atlantic states have executed it. Each signatory state is to appoint three representatives to an interstate commission which shall ascertain methods to conserve marine, shell anadromous fisheries. The commission shall draft and recommend legislation to the various states, advise administrative agencies as to problems of fisheries and recommend stocking programs. The federal fish and wildlife service of the department of the interior shall act as research agency for the commission. An advisory committee of commercial fishermen and salt-water anglers shall be set up to advise the commission. Each member state agrees to contribute to the support of the commission in proportion to the value of its fisheries' products. Each state initially agrees to contribute an amount based upon the catch record of 1938. Subsequent budgets will be recommended by a majority of the commission. The governor of Maryland is authorized to execute the compact on behalf of Maryland. The Maryland commission members are the director of the Department of Tidewater Fisheries, a legislator who is a member of the commission on interstate cooperation, and a private citizen appointed by the governor. (Shevin-Fla)
W69-09080

CONSERVATION OF WOODLAND AREAS.
Md Ann Code art 66C secs 411 1/2 (1957).

Descriptors: *Maryland, *Forest management, *Contracts, *Taxation, Assessments, Tax rate, Payment, Contract administration, Floods, Forest soils, Natural resources, Forests, Erosion, Economics, Land tenure, Conservation, Recreation, Value, Property values, Legal aspects, Legislation, Crop production, Productivity, Private rights, State governments, Flood control, Administrative agencies.

A program of forest conservation and management under The Department of Forests and Parks is established to encourage development of productive woodlands, prevent floods and soil waste, increase individual incomes from sale of timber, and provide wooded areas for use and enjoyment. Owners of 5 or more contiguous acres may agree with the Department to place his land within the program. A contract under this section may be assigned to a buyer of all or a portion of a tract, and no new assessment shall be required. (Harris-Fla)
W69-09081

DRAINING PRIME HOOK CREEK; VIOLATION AND PENALTY.
Del Code Ann tit 7, sec 766 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Drains, *Landfills, *Dams, Legislation, Muskrats, Agriculture, Pastures, Hay, Boats, Tributaries, Obstruction to flow, Streams, Marshes, Legal aspects, Seasonal.
Identifiers: *Delaware Bay, Penalties (Civil), Penalties (Criminal).

No person shall open any drain which would permit draining of Prime Hook Creek into the Delaware Bay between October first and March tenth each year. Any person at his own expense may, between these dates, fill any drains on the creek to hold back sufficient water to float small boats used in the muskrat industry provided written consent is obtained from the owner of lands where the fills are to be made. After March tenth, such fills must be removed so as to permit the creek to drain freely into the bay. Any person may at his own expense, between March tenth and October first, open drains in the creek provided written consent is obtained from the owner of the lands where the drain is to opened. The purpose for this last provision is to allow the creation of a large acreage of marsh available for pasturing and cutting hay. Violations of any provision of this section are punishable by fine and/or imprisonment. (Kahle-Fla)
W69-09082

RESTRICTIONS ON BOATING.

NH Rev Stat Ann secs 486:1 thru 486:7 (1968).

Descriptors: *New Hampshire, *Recreation, *Regulation, Water sports, State jurisdiction, Water utilization, Surface waters, Natural resources, Boats, Boating, Legal aspects.

Motor boats shall not be used or operated on Lake Whittemore, Abbot Forest Pond, or Tolman Pond. The use of any houseboat on Squam and Conway Lakes and Silver Lake in Madison is prohibited. A fine for violating this section is provided. The operation of any boat propelled by electric, naptha, gasoline, steam, or other mechanical power on Lucas Pond is prohibited. Special regulations relating to other water bodies are provided. (Moulder-Fla)
W69-09083

SUBAQUEOUS LANDS.
Del Code Ann tit 7, secs 6451-6459, 6461 (Supp 1966).

Descriptors: *Delaware, *Ownership of beds, *Leases, *Easement, Legislation, Administrative agencies, Public rights, State governments, Permits, Investigations, Administrative costs, Governors, Beds, Beaches, Shores, Beds under water, Land tenure, Public lands.
Identifiers: Subaqueous lands, Applications, Water and Air Resources Commission.

The Governor and the Water and Air Resources Commission shall have exclusive jurisdiction to convey fee simple or lesser interests in the public lands of the state which are submerged. Anyone applying for any interest in these lands must file a request with the commission stating the type of lease, permit or grant desired. The commission shall hold a public hearing if the interest requested is in excess of ten years, if a written objection to the application is filed or if the commission feels that a hearing would be in the public interest. The commission shall publish notice of the application and of any public hearing. The commission may appoint an investigative board to investigate any application. The board shall make recommendations to the commission. The commission shall recommend to the Governor the granting or denial of an application. The Governor shall not execute any lease, permit, deed, or other grant unless it conforms to the recommendations of the commission. The Governor may refuse to approve any application at his discretion. Any interest conveyed under this statute shall be subject to any lease previously given on such land by the Shell Fisheries Commission. (Gadd-Fla)
W69-09084

NATURAL RESOURCES CONSERVATION.

Del Code Ann tit 7, sec 6001 (Supp 1966).

Descriptors: *Delaware, *Water policy, *Resource development, *Water resources, Governments, Administrative agencies, Legislation, Legal aspects, State governments, Federal government, Local governments, Water resources development, Conservation, Wildlife conservation, Natural resources, Administration, Multiple-purpose projects, Planning, Water conservation, Water utilization, Regulation, Control, Long-term planning, Programs, Water supply.

The public policy of this state shall be the development, utilization, and control of all water, underwater and air resources for the maximum beneficial use of its people. Such resources are to be developed and controlled by the Water and Air Resources Commission which is charged with carrying out said public policy. Of special concern to the legislature are: (1) assurance of adequate supplies of these resources for domestic, industrial, power, recreational, and other beneficial uses; (2) regulation and development of water resources in general; and (3) protection and conservation of water, underwater and air resources, for public recreation, and for conservation of wildlife and aquatic life. Programs to initiate and conduct research in these areas and to foster cooperation with federal, state, and local governmental agencies are established by this section with the aim of carrying out the above enumerated policies of the state. (Johnson-Fla)
W69-09085

BOARDS OF DITCH COMMISSIONERS; FORMATION OF A TAX DITCH: PROCEDURE.
Del Code Ann tit 7, secs 4106-4143 (1953), as amended, (Supp 1966).

Descriptors: *Delaware, *Administrative agencies, *Drainage programs, *Drainage districts, Legislation, Local governments, Ditches, Adjudication procedure, Decision making, Administrative costs, Cost sharing, Taxes, Assessments, Costs, Flood protection, Compensation, Damages, Right-of-way, Feasibility studies, Cost-benefit analysis, Investigations, Project planning, Legal aspects, Public rights, Watershed management.
Identifiers: Tax ditches.

Any person can petition the superior court, through the County Soil Conservation District, for the establishment of a tax ditch. A tax ditch is a government subdivision organized to construct a drainage system to drain lands or protect them from flooding. The petitioner must use a particular form and deposit a sum for administrative costs of processing the petition. The soil district through investigation and hearings shall determine the feasibility of the proposed tax ditch. If the district determines the tax ditch is feasible then the ditch commissioners of the county concerned shall make determinations as to the construction needed, the boundaries of the watershed, the permanent rights-of-way needed, the damages to private property, the compensation for improvements already constructed, and the estimated cost of all work to be done. The resident associate judge of the county shall appoint the ditch commissioners and they may get aid from the state drainage engineer. The commissioners shall also compile an assessment list of all affected landowners for distribution of costs. A public hearing of all affected landowners is to be called by the commissioners to obtain opinions and objections on the commissioners' findings. A report of these findings including the results of a referendum of the property owners shall be sent to the superior court. The court shall hold a final hearing and decide on the tax ditch based upon the benefit to the public, the report of the commissioners and the referendum. (Gadd-Fla)
W69-09086

ATLANTIC STATES MARINE FISHERIES COMPACT.

Del Code Ann tit 7, sec 1501-1505 (1953).

Descriptors: *Delaware, *Interstate compacts, *Fish conservation, *Fish management, Fisheries, Fish stocking, Anadromous fish, Atlantic Ocean, Fish harvest, Fishing, Commercial fishing, Sport fishing, Costs, Administrative agencies, Regulation, Federal government, State governments, Financing, Interstate commissions, Legislation, Legal aspects.
Identifiers: Department of the Interior.

The governor shall execute the Atlantic States Marine Fisheries Compact with any of the Atlantic seaboard states or states contiguous thereto with waters frequented by anadromous fish. The agreement shall have for its purpose the better utilization of fisheries through a joint protection program. Each state shall appoint three representatives, one to be the executive officer of the state agency concerned with fisheries, one a legislator, and one a private citizen, to the Atlantic States Marine Fishe-

ries Commission. The Commission shall have power to: ascertain methods to prevent depletion of fisheries; recommend methods for coordination of police powers; recommend regulations to proper state agencies; and recommend to party states the stocking of waters with fish or fish eggs. The Fish and Wildlife Service of the federal Department of the Interior shall act as the primary research agency for the Commission. A committee of commercial and sport fishermen shall be appointed to advise the Commission in its recommendations. Each state shall make appropriation to the Commission in proportion to the market value of its fishery products as well as an initial stated contribution. Pursuant to the compact the three members of the Commission from Delaware are appointed. (Kahle-Fla)
W69-09087

CONSERVATION--FISHING IN CERTAIN WATERS.

Del Code Ann tit 7, sec 1101-1124 (1953), as amended, (Supp 1968), secs 1125-1130 (Supp 1968).

Descriptors: *Delaware, *Freshwater fish, *Sport fishing, *Fish management, Fish conservation, Legislation, Regulation, Fishing gear, Pollution, Fish stocking, Nets, Bass, Carp, Pikes, Walleye, Eels, Herrings, Permits, Water pollution control, Seasonal.
Identifiers: Shad, Penalties (Civil), Limits.

Game and certain other fish are protected by regulations set out in this chapter. Various open seasons are provided, with a closed season on herring after June. Minimum legal sizes are set out, and daily limits allow a catch of 6 for most varieties. Game fish may only be taken by hook and line under immediate observation of the fisherman. Nets and other devices are generally prohibited in freshwater, except for minnow nets and dip nets. Non-game fish may be taken by net with a permit. Nets may be used in tidal waters with some exceptions. No season is provided for carp, and they may be taken with nets in meadows and ditches. Net fishing is prohibited on Sunday and shad fishing on Saturday and Sunday. Specific regulations provide for particular fish, bodies, devices, and non-residents. Pollution is prohibited that causes damage to fish life. Penalties for violation of these regulations are provided. Provisions are made for a freshwater trout stamp, the proceeds from which are used for restocking trout. (Douberley-Fla)
W69-09088

HEALTH AND SAFETY (ADMINISTRATIVE AUTHORITY FORMATION).
For primary bibliographic entry see Field 05G.
W69-09089

INVESTIGATION OF HIGH AND LOW LEVELS.
For primary bibliographic entry see Field 04A.
W69-09090

ROSE V STATE (APPROPRIATION OF RIPARIAN RIGHTS).

24 NY 2d 81, 298 NYS 2d 968-978 (1969).

Descriptors: *New York, *Riparian rights, *Alteration of flow, Riverbeds, Competing uses, Diversion, Industrial water, Obstruction to flow, Water loss, Judicial decisions, Legal aspects, Appropriation, State government, Compensation, Damages, Factories, Water utilization.
Identifiers: *Chenango River, Chenango, Broome County.

Plaintiff owned two corporations engaged in processing and selling gravel, sand, stone, and concrete from plants located on property abutting the Chenango River. The water source was necessary due to the quantity of water required in the manufacturing process. The state of New York changed the riverbed from the area in which the corporation maintained their water intake line. The corporation was forced to relocate its plants. Plaintiff sued for compensation for the destruction of the corporate riparian rights. The court held that where the state takes property, the owner must be indemnified, insofar as possible, and the owner was entitled to compensation for injuries to the business' assets. The state was liable for moving fees or the difference between salvage and reproduction cost less depreciation, which ever amount was smaller. (Moulder-Fla)
W69-09091

CONDEMNATION OF LANDS OR RIGHTS-OF-WAY: WRITTEN NOTICE TO LANDOWNER.

SC Code Ann sec 58-771 (1962).

Descriptors: *South Carolina, *Condemnation, *Railroads, Canals, Right-of-way, Compensation, Legislation, Legal aspects, Public rights, Eminent domain, Land tenure, Land use, Construction, Appropriation.
Identifiers: Legal notice.

Whenever any person shall be authorized by charter to construct a railway or canal in South Carolina, and it is to be constructed across private lands, such person shall give proper notice to the landowners involved that a right-of-way is required for construction. Such notice must be given 30 days before entering upon any lands to begin construction, and shall be served upon such owner in the same manner as required by law for the service of a summons in civil actions. (Carruthers-Fla)
W69-09092

PAY STATE LOBSTER CO., INC. V PERINI CORP. (DAMAGE CAUSED BY DREDGING).

245 NE 2d 759-760 (Mass 1969).

Descriptors: *Massachusetts, *Dredging, *Lobsters, *Permits, Judicial decisions, Contracts, Silts, Water pollution effects, Water circulation, Intake structure, Commercial fishing, Water pollution sources, Commercial shellfish, Damages.
Identifiers: United States Coast Guard, Negligence.

Plaintiff sued for damages caused by defendant's dredging of Boston Harbor which raised silt and killed plaintiff's lobsters. Defendant had been warned but continued dredging. The attachment of extension pipelines to the lobster tanks' intakes would have alleviated the problem. Defendant had the technical competence to install the pipes and it would have been inexpensive in relation to what defendant would receive for the dredging. Defendant only attempted to install one pipeline after ten days of dredging. Plaintiff did not have the technical competence to install the pipelines and could not have had them installed for three or four months. These facts warranted a finding of negligence against the defendant. Defendant was not relieved of his negligence by his contract for the dredging with the United States Coast Guard nor by his license from the Department of Public Works. (Gadd-Fla)
W69-09093

FERRIES.

Ill Ann Stat ch 55, secs 20.21 (Smith-Hurd 1967).

Descriptors: *Illinois, *Transportation, *Boats, Ohio River, Land tenure, Boating, Watercourses (Legal), Lakes, Rivers, Legislation, Legal aspects, Permits, Streams, Public rights, Reasonable use, Compensation, Public benefits, Repairing.
Identifiers: *Ferries, Penalties (Civil), Fines.

All ferries established over the Ohio River, or over any waterway within this state, which have been kept in operation and repair and have not been discontinued or abandoned since their establishment, shall be declared established ferries within the meaning of this act and entitled to the benefits of the same. The penalty for operating any boat or other craft as a ferry without a license and within 3 miles of any established ferry, shall be forfeiture of such boat or craft to the ferry owner and a fine of $15 for each person who was thus unlawfully conveyed to be paid to the ferry owner. Nothing herein shall be construed to prevent private, noncommercial use of one's own boat or craft to cross any stream or watercourse or to cross himself and his neighbors when done without fee and when the established ferry is not in actual operation or in sufficient repair to afford a safe and speedy passage to persons and property. (Carruthers-Fla)
W69-09094

PUBLIC SERVICE COMPANIES.
For primary bibliographic entry see Field 04A.
W69-09095

KEATOR V STATE (CONDEMNATION OF RIPARIAN PROPERTY).

23 NY 2d 337, 244 NE 2d 248-250 (1968).

Descriptors: *New York, *Condemnation value, *Riparian land, *Recreation facilities, Condemnation, Damages, Adjudication procedure, Land use, Riparian rights, Delaware River, State governments, Land appraisal, Construction costs, Depreciation, Compensation, Property values, Legal aspects, Judicial decisions, Value.

Plaintiff's property, located on the Delaware and used as a clubhouse and meeting place, was condemned by the state. Plaintiff was awarded $15,900. The first appellate court reduced the award to $12,000 holding that the trial court incorrectly added building reproduction costs to land value without any suggestion that the property was either unique or a specialty. This court, on appeal by the plaintiff, reinstated the trial court's award. Just compensation should normally be determined by fair market value, but fair market value, in turn, must be based upon the highest and best use of the property. Since the evidence showed that the best use of this property was as a clubhouse, it could be termed a 'specialty' and as such was not susceptible to the rule of fair market value. An award based on the current cost of reproduction less depreciation was proper. (Kahle-Fla)
W69-09096

NAVIGABLE WATERS FREE.
SC Const art 1, sec 28 (1962).

Descriptors: *South Carolina, *Navigable waters, *Public rights, *Water policy, Navigation, Water law, Legislation, Legal aspects, Political aspects, Jurisdiction, Navigable rivers, Water rights, Riparian rights, Riparian waters, Transportation, Taxes, Shores, Usufructuary right.
Identifiers: Constitutional provisions.

All navigable waters are public highways free to the citizens of the state and the United States without tax, impost or toll imposed. Similarly no tax, toll, impost or wharfage may be imposed upon the owners of any merchandise or commodity for the use of the shores or any wharf erected on the shores or in or over the waters of any navigable stream unless the same be authorized by the general assembly. (Johnson-Fla)
W69-09097

EMINENT DOMAIN.

SC Const art 14, sec 1 (1962).

Descriptors: *South Carolina, *Boundaries (Property), *Navigation, *Navigable waters, Eminent domain, Water policy, Water law, Legislation,

Political aspects, Legal aspects, Jurisdiction, State governments, Public rights, Taxes, Navigable rivers, Water rights, State jurisdiction.

The state has concurrent jurisdiction on all rivers bordering on it so far as such rivers form a common boundary. Such rivers, together with all navigable waters within the state, are common highways and shall be forever free not only to inhabitants of the state but also to all citizens of the United States, without any tax or impost therefore, unless the same be expressly provided for by the general assembly. (Johnson-Fla)
W69-09098

WELL DRILLERS.
Md Ann Code art 96A:80-88 (Supp 1968).

Descriptors: *Maryland, *Wells, *Well regulat ions, *Drilling, Administrative agencies, Well permits, Permits, Water permits, Water wells, Legislation, Logging, Water conservation, Dri ll holes, Excavations, Pipes, Casings, Subsurface investigations, Legal aspects, Regulation, Control.
Identifiers: *Licenses.

This statute creates the Maryland State Board of Well Drillers. The board is authorized to grant licenses to anyone intending to engage in well drilling. No one shall practice the business of well drilling unless he has a license. The board may revoke or suspend a license for: (1) fraud or decei t in obtaining a license; or (2) gross negligence, incompetence or misconduct in the well drilling business. There shall be a hearing by the board upon any charge leading to revocation or suspension. Any accused licensee shall have the right to appear in person and by counsel to cross-examine witnesses and present his own witnesses. Anyone aggrieved by a final decision of the board shall have the right to judicial review. The board may enter into reciprocity agreements with the licensing agencies of other states. Any person engaging in the well drilling business without a license shall be subject to a fine. (Helwig-Fla)
W69-09099

CLARK'S HILL AUTHORITY.

SC Code Ann, secs 59-91 thru 59-93 (1962).

Descriptors: *South Carolina, *State governments, *Federal Government, *Project planning, Projects, Project purposes, Public benefits, Streams, Canals, Watercourses, Interstate rivers, Interstate compacts, Administrative agencies, Legislation, Legal aspects, United States, Georgia.
Identifiers: Savannah River, Clark's Hill Project.

There is hereby established Clark's Hill Authority of South Carolina. It shall consist of and be governed by an 11 member board appointed by the governor. The Authority may: (1) inquire into the plans for development of the Clark's Hill Project by the United States Government, by Georgia or by any other agency; (2) encourage, promote and cooperate in the development of the Clark's Hill Project and of the Savannah River and any watercourses flowing into same; (3) negotiate agreements, accords or compacts in the name of the state with Georgi a, the United States or any other state or agency relating to the development of the Clark's Hill Project, the development of the Savannah River and waterways flowing into said river. Any agreement, accord or compact made by the Authority shall be subject to approval by concurrent resolution of the general assembly. (Carruthers-Fla)
W69-09100

ACQUISITION OF LANDS AND CONDEMNATION THEREOF.

SC Code Ann secs 59-221, 59-222, 59-224 (1962).

Descriptors: *South Carolina, *Condemnation, *Cities, *Water supply, Right-of-way, Legislation, Streets, Public health, Dams, Canals, Lakes, Pollution abatement, Drainage, Drainage systems, Compensation, Land tenure, Streams, Operation and maintenance, Municipal water, Watershed management, Surface runoff, Surface drainage, Drains, Surface waters, Legal aspects, Local governments.

Cities and towns may purchase and hold suitable lands and water and erect aqueducts, dams, canals, and other such works as may be necessary to obtain and secure a supply of water. The city shall have the right to condemn: (a) any lands, the drainage from which would contaminate the water supply of the city; (b) such streams and lakes as may be required for the water supply; and (c) rights-of-way in order to operate aqueducts, dams, and canals. Just compensation shall be paid as provided for by law. Any municipal corporation desiring to establish or extend waterworks may condemn water rights and water privileges. Such corporation may also condemn lands for the purpose of protecting watersheds from contamination, nuisances, or any condition menacing to public health. Proper compensation shall be made. If surface water is carried off from any street or public thoroughfare, such municipality shall provide sufficient drainage for the surface water through open or covered drains in such manner as to prevent passage of the wat er over private lands. However, if such drains cannot be had along such thoroughfares, the municipality may obtain a right-of-way through the private lands for the necessary drains. (Heckerling-Fla)
W69-09101

WATERSHED CONSERVATION DISTRICTS.
For primary bibliographic entry see Field 04D.
W69-09102

ARKANSAS POWER AND LIGHT CO. V CASH (OPERATION OF DAMS IN FLOODS).
For primary bibliographic entry see Field 04A.
W69-09103

MICHIGAN STATE HIGHWAY COMM'N. V MCLAUGHLIN (CONDEMNATION VALUES AND SPECULATIVE BENEFITS).
167 NW 2d 468-470 (Ct App Mich 1969).

Descriptors: *Michigan, *Condemnation, *Condemnation value, *Damages, Benefits, Eminent domain, Ponds, Right-of-way, Borrow pits, Remedies, Legal aspects, Judicial decisions, Administrative agencies, Property values, Real property.

Plaintiff Michigan State Highway Commission insfituted proceedings to effect the condemnation of a portion of defendants' land for the construction of part of an interstate highway. Plaintiff also asked for the right to construct a temporary road on defendants' property and the right to remove sand, gravel, and earth for highway construction purposes. Plaintiffs claimed defendants should not receive any compensation because the benefits to defendants' property exceeded the damage. The claimed benefits accrued when the excavation left a pond which plaintiffs argued could be developed into a resort, though admittedly only at considerable expense. When the trial court instructed the Commission to calculate the value of the borrow by using either units of cubic yards or acres and to take into consideration any benefits accruing to the land in determining damages, defendant appealed. The court remanded because of improper instructions to the Commission. To promote consistency in determining the value of a borrow, the valuation must be based on the actual number of cubic yards taken. Furthermore, it is improper in weighing damages to take into account those speculative benefits which could only be obtained by expensive alterations on preparations. (Gabrielson-Fla)
W69-09104

EDWARD V MASSETT (IMPROVEMENT OF STREAM AS DRAINAGE OUTLET).
For primary bibliographic entry see Field 04A.
W69-09106

GENERAL PROVISIONS AS TO FISH AND GAME.
NH Rev Stat Ann secs 207:1, 207:2, 207:5, 207:8-207:10, 207:14-207:21, 207:31, 207:36, 207:40-207:44, 207:46, 207:47 (1964).

Descriptors: *New Hampshire, *Wildlife management, *Fish conservation, *Fish management, Legislation, Water law, Water policy, Legal aspects, Control, Regulation, Permits, Conservation, Fish, Fish establishment, Fish harvest, Administration, Fishing, Water utilization, Water sports, Hunting.
Identifiers: Possession limits.

Fishing, unless otherwise permitted, may be done only by angling. Certain devices are absolutely prohibited. These include snatch hooks, spears and grapling hooks. No living fish or fry may be imported into the state or released into the state's waters without a proper permit. Possession of fish out of season is prima facie evidence of unlawful taking by the possessor and all fish illegally taken must be seized by conservation officers. Transportation of up to two days limit on fish is authorized by this chapter with the special limitation that fish shipped by common carrier must be properly marked as set out in this section. When there is a danger of starting fires, the governor and council may, upon joint recommendation, declare any or all woodlands closed to hunters, fishermen, and trappers. Upon a proper hearing certain waters may be closed to public use to protect a crop of ice while it is being formed, cut and harvested. Foreign hunt clubs must be incorporated in the state before they may acquire any property in the state. (Johnson-Fla)
W69-09107

METHOD AND MANNER OF TAKING FISH.
For primary bibliographic entry see Field 08I.
W69-09108

LOBSTERS AND CRABS.

NH Rev Stat Ann secs 211:18-211:45 (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Lobsters, *Crabs, *Regulation, Control, Shellfish, Inspection, Legal aspects, Legislation, Water policy, Permits, Commercial shellfish, Crustaceans, Commercial fishing, Conservation, Fish conservation, Trapping.
Identifiers: Licenses.

To take crabs and lobsters within the state one must procure a special license, and before receiving such license one must show proof that he has resided within the state for at least five years immediately preceding his application. The five-year resident requirement may be waived in case of a resident who does not at any time use more than five lobster traps. Female lobsters carrying spawn must be marked and immediately returned to the water. Lobsters so marked must be returned to the water if taken again. It is illegal to possess, sell, or transport lobsters if less than 3 1/8 inches in length. Lobster and crab traps must be clearly marked with the owner's initials and properly buoyed. A conservation officer may board any vessel, and such vessels' crews may not throw any materials overboard upon noticing his approach; such officer may inspect without a search warrant upon reasonable cause to suspect a violation of this chapter. Both retail and wholesale dealers in crabs and lobsters must obtain a proper license for same. (Johnson-Fla)
W69-09109

PUBLIC FOREST LANDS.

NH Rev Stat Ann secs 219:7-a, 219:8-a (1964).

Descriptors: *New Hampshire, *Islands, *Recreation facilities, *Parks, Recreation, Public benefits, Ponds, Boating regulations, Regulation, Administrative agencies, Legislation, Lakes, Conservation, Forest management, State governments.
Identifiers: Legal aid.

Listed islands are placed under the jurisdiction of the Department of Resources and Economic Development as public reservations. The Department shall have no authority to sell or dispose of such islands, and title to such islands is not affected. The Department may prescribe rules and regulations for the use of boats on Mill Pond and North Pond in Pillsbury State Park and Spruce Pond and Bear Hill Pond in Bear Brook State Park. (Kahle-Fla)
W69-09110

POWERS TO LAYOUT HIGHWAYS.

NH Rev Stat Ann secs 232:3, 232:6 (1964).

Descriptors: *New Hampshire, *Highways, *Highway construction, *Highway effects, Bridges, Bridge construction, Bodies of water, Streams, Navigable waters, Boats, Navigation, Lumber, Legislation, Regulation, Local governments, Administrative agencies.
Identifiers: Obstruction to navigation.

Highways to public waters, not part of a primary or secondary highway system, may be laid out as class V highways by the city officials of the city in which the highway is located, or may be laid out as provided by a commission appointed by the governor and council. A highway, or an alteration thereof, may be laid out across any body of water unless such bridge or highway may prevent the use of such waters for navigation or for running timber. (Kahle-Fla)
W69-09111

POWERS OF CONSERVATION DISTRICTS AND SUPERVISORS.

NH Rev Stat Ann sec 430-B:9 (1968).

Descriptors: *New Hampshire, *Soil conservation, *Land management, *Flood control, Adoption of practices, Financing, Erosion control, Legislation, Legal aspects, Water law, Administrative agencies, Administration, Natural resources, Soil stabilization, Soil management, Land, Land development, Land reclamation, Sediment control, Flood damage, Projects, State governments, Federal government, Resource development, Planning.
Identifiers: *Conservation districts.

The conservation districts and supervisors thereof have the power to conduct surveys, investigations and research relating to the character of soil erosion, floodwater and sediment damages and land drainage as well as to promote conservation and development of soil, water and related natural resources. Such research may not be initiated by any district except in cooperation with the state or federal government in order to avoid duplication. Demonstration projects and preventive control measures may be carried out by such districts which will furnish certain financial aid therefore. The districts are authorized to acquire real and personal property in this regard and may manage federal property located therein. The districts also may furnish written reports, machinery and fertilizer to land occupiers within their jurisdiction. Each district should develop comprehensive plans for the development and conservation of soil within its bounds. Before receiving benefits from the district, landowners may be required to contribute money, materials or land for the purposes outlined herein. (Johnson-Fla)
W69-09112

NEGLECT OF TOWN TO BUILD HIGHWAYS OR BRIDGES.

Vt Stat Ann tit 19, secs 571-574, 631-636, 640-647 (1968).

Descriptors: *Vermont, *Bridge construction, *Administration, *Local governments, Legislation, Legal aspects, Water law, Bridges, Civil engineering, Jurisdiction, Financing, Planning, Regulation, Political aspects.

When a town fails to build a bridge as mandated by the supreme or county court the original petitioners for same may apply for a fine to be assessed against the town in an amount sufficient to build such a structure. The money thus received is applied to such construction under the direction of a court appointed commissioner provided, that if the bridge is discontinued, the court may order the money to be returned to the town. Either by petition of freeholders or agreement of the selectmen bridges may be constructed between two towns and the expense apportioned as they agree. When selectmen fail to take action on a freeholder petition resort may be had to the county court on application of twenty or more freeholders. The court appoints three disinterested freeholders who hold a hearing to determine the necessity of such a bridge and the appropriate expenses to be borne by each town. A report of their findings must be filed with the court which may order the building of such bridge. (Johnson-Fla)
W69-09113

HIGHWAYS AND BRIDGES.
Vt Stat Ann tit 19, secs 931-933 (1968).

Descriptors: *Vermont, *Administrative agencies, *Local governments, *Maintenance, Highways, Bridges, Jurisdiction, Repairing, Legislation, Legal aspects, Water law, Civil engineering, Operation and maintenance.

Each town is responsible for repair of highways and bridges throughout all seasons of the year if they are not part of the state highway system. Towns must cause covered bridges or highways to be appropriately lighted. If a town has no agents for these purposes or if such agents refuse or neglect to perform these duties, the selectmen in each town are charged with the responsibility of seeing that these functions are performed. (Johnson-Fla)
W69-09115

FLOODS, STREAMS, AND DRAINAGE.
For primary bibliographic entry see Field 04A.
W69-09116

MILLS, DAMS OR BRIDGES.
Vt Stat Ann tit 13, sec 3733 (1958).

Descriptors: *Vermont, *Damages, *Dams, *Bridges, Mills, Reservoirs, Gates, Flumes, Legislation, Engineering structures, Legal aspects.
Identifiers: Penalties (Criminal), Water mill, Toll bridge.

Any person who willfully and maliciously injures, removes or opens a dam, reservoir, gate, or flume or injures or removes the wheels, mill gear, or machinery of a water mill, or injures, removes or destroys a public toll bridge shall be either imprisoned or fined. (Shevin-Fla)
W69-09118

ILLINOIS AND DESPLAINES RIVERS.
For primary bibliographic entry see Field 04A.
W69-09119

TRI-CITY PORT DISTRICT.

Ill Ann Stat ch 19, secs 285, 287, 297 (Smith-Hurd 1963), as amended, (Supp 1969).

Descriptors: *Illinois, *Port authorities, *Harbors, *Navigable waters, Permits, Piers, Docks, Structures, Bridges, Boundaries (Property), State jurisdiction, Bodies of water, Legislation, Administrative agencies, Regulation, Boating regulations, Planning, Landfills, Construction, Obstruction to flow, Boats, Ships, Bridge construction, Landfills, Legal aspects.
Identifiers: Obstruction of navigation.

The Tri-city Regional Port District has power to issue permits for the erection of any structure within 40 feet of any navigable waters within the Port District and for the deposit of any fill in said waters. No such permit is necessary for the erection by a city of a bridge crossing a waterway which serves as a boundary between Illinois and another state. Applications for permits shall include plans and specifications and such other information as may be required by the Port District. No such permit is required if a permit was acquired from the proper agency prior to the creation of the Port District and in the case of projects by certain cities and agencies. Structures erected without permits may be removed at the expense of the responsible party or, if it is decided by the Port District that such structure or deposit may remain, the Port District may regulate its use. The district may remove obstructions from navigable waters, establish dock, shore and harbor lines, and regulate anchorage, speed of vessels, and operation of bridges within the district. 'Navigable waters' are defined as 'any public waters which are or can be made usable for water commerce.' (Kahle-Fla)
W69-09120

KASKASKIA REGIONAL PORT DISTRICT ACT.

Ill Ann Stat ch 19, secs 502, 507, 530 (Smith-Hurd Supp 1969).

Descriptors: *Illinois, *Navigable waters, *Navigation, *Regulation, Structures, Bridges, Breakwaters, Bulkheads, Weirs, Piers, Jetties, Rocks, Sands, Obstruction to flow, Docks, Harbors, Boats, Boating regulations, Administration, Administrative agencies, Legislation, Legal aspects, Water law, Transportation, Construction, Permits, Landfills, Rock fills, Cities, Shores.
Identifiers: *Port district, Penalties (Criminal), Public waters.

'Navigable waters' means any public waters which are or can be made usable for water commerce. The Kaskaskia Regional Port District has the following rights and powers: (a) issue permits for the construction of all structures of any kind, over, under, in or within 40 feet of any navigable water within the port district and for the deposit of fill materials of any kind in such waters; (b) prevent and remove obstructions, including the removal of wrecks; (c) locate and establish dock lines, anchorage and shore or harbor lines; and (d) regulate the anchorage, moorage and speed of vessels and establish and enforce regulations regarding bridge operation beyond the jurisdiction of any municipality. It is unlawful to deposit fill or refuse of any kind or build any structure within 40 feet of any navigable water within the port district without first receiving a permit therefore from the port district. Violators of this requirement shall, upon conviction, be fined, imprisoned or both. Any structure, fill or deposit erected or made in violation of this section is declared to be purpresture and may be abated. If the port district decides that such structure, fill or deposit may remain, the port district may make any rules, regulations, changes, and repairs it deems necessary to protect the interest of the port district. (Carruthers-Fla)
W69-09122

PURE WATERS BOARD.
For primary bibliographic entry see Field 05G.
W69-09123

WATERWORKS AND FILTRATION PLANTS.

Ill Ann Stat ch 105, sec 327X (Smith-Hurd 1952).

Descriptors: *Illinois, *Waterworks, *Land use, *Construction, Legislation, Buildings, Land management, Riparian rights, Ownership of beds, Riparian land, Beds under water, Cities, Water purification, Land, Tunnel construction, Intakes, Breakwaters, Legal aspects, Real property.
Identifiers: *Public waters, Submerged lands.

Any park commission which has acquired the title to land adjacent to or adjoining any public waters, to the submerged lands and beds of such public waters or to any riparian rights in relation to such waters may grant any of these lands or rights to any city which has a population of 500,000 or more and which operates its waterworks system. The conveyed land or rights may be used as a site for buildings and other structures for improving the waterworks system and for the construction of water purification plants, intakes, tunnels, breakwaters and other structures connected with the waterworks system. (Shevin-Fla)
W69-09124

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09125

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09126

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09127

RIVER CONSERVANCY DISTRICTS.
For primary bibliographic entry see Field 05G.
W69-09128

JURISDICTION OVER LAKE MICHIGAN; JURISDICTION OVER RIVERS.

Ill Ann St at ch 34, secs 2, 3 (Smith-Hurd 1960).

Descriptors: *Illinois, *Jurisdiction, *Boundaries (Surfaces), *Rivers, Legislation, Local governments, Lake Michigan, Mississippi River, Ohio River, Legal aspects.

Each county bounded by either the Mississippi, Ohio or Wabash River shall have jurisdiction over such river to the extent it is so bounded which jurisdiction may be exercised concurrently with the contiguous states bounded by such river. Each of the counties bordering on Lake Michigan shall have jurisdiction over said lake eastwardly, to the east line of the state. (Heckerling-Fla)
W69-09129

ACQUISITION OF PROPERTY NECESSARY TO STRAIGHTEN DITCH.
Ill Ann Stat ch 121, secs 4-502 (Smith-Hurd 1960).

Descriptors: *Illinois, *Ditches, *Eminent domain, *Drains, Watercourses (Legal), Administrative agencies, State governments, Drainage engineering, Surface waters, Road construction, Compensation, Repairing, Highways, Legislation, Legal aspects.

When the State Highway Department deems it necessary to build, widen, alter, relocate or straighten any ditch, drain or watercourse in order to drain any highway it is authorized to construct, maintain or operate, it may acquire the necessary property by gift or purchase, or if the compensation or damages cannot be agreed upon, by the exercise of eminent domain. The Department shall not be required to furnish bond in any eminent domain proceeding. (Shevin-Fla)
W69-09130

TOLL BRIDGES.
Ill Ann Stat ch 137, secs 1, 2, 5 (Smith-Hurd 1964).

Descriptors: *Illinois, *Bridges, *Navigable waters, *Land tenure, Legislation, Navigation, Local governments, Bridge construction, Watercourses (Legal), Lakes, Rivers, Legal aspects, Regulation.
Identifiers: *Toll bridges, Obstruction to navigation.

No toll bridge shall be established or erected across any lake, river, creek, or other water course in this state without the consent of the county board of the county in which the bridge is to be established or erected. No bridge shall be constructed over any navigable water without a suitable draw for the passage of watercraft, nor in any manner so as to interfere with navigation. Owners of land along the watercourse over which a toll bridge is proposed to be established shall have the preference in applying for the right to build such bridge. (Heckerling-Fla)
W69-09131

INTRASTATE, INTERSTATE, AND INTERNATIONAL LEGAL AND ADMINISTRATIVE PROBLEMS OF LARGE-SCALE WATER TRANSFER,
Department of the Interior, Washington, D.C. Office of the Solicitor.
Edward Weinberg.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 352-358, University of Arizona Press, Tucson, 1969. 7 p.

Descriptors: *Interbasin transfers, *Water law, Legal aspects, Southwest U.S., Export, Water transfer, Water conveyance, Water management (Applied), Administrative agencies, Coordination, Water allocation (Policy), Jurisdiction, Negociations, Project planning, Administrative decisions, Water law, Federal-state water rights conflicts, Legislation, Interstate.
Identifiers: Canada, North American Water and Power Alliance, Colorado River Basin Project Act.

Some of the major legal developments in the U.S. concerning large-scale transfers of water between basins are discussed. In particular the Colorado River Basin Project Act of 1968 is considered. One major problem of transfers revolves around the apprehension of the people of the area of origin as to how the project might inhibit what they believe to be their opportunities for long term economic growth. The 10 yr. moratorium on studies of importations into the Colorado River basin allows focus of attention on alternatives. The North American Water and Power Alliance proposal serves as an illustration of the international legal problems developing from large scale water transfer. Several of these are discussed and some questions are posed. The diversity of agencies responsible for the U.S. governments planning, construction, funding and operation of water resources projects is compared to the advantages and disadvantages of one centralized authority. It is concluded that the diversity of interests represented by the many agencies is a good guarantee of development approaching the optimum. (See W69-09210). (Sherbrooke-Ariz)
W69-09216

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501, art 1, 2, 3, 11, 13, 14 (Supp 1966).

Descriptors: *River basin development, *Interstate compacts, *Water utilization, Water resources development, Water allocation (Policy), Water distribution.
Identifiers: *Delaware River Basin, INCODEL.

The Interstate Commission of the Delaware River Basin (INCODEL) replaced numerous federal and state agencies in exercising authority over the basin. The governors of the parties--Delaware, New Jersey, New York, Pennsylvania, and a federal commissioner are members; each member has one vote. The Commission develops and effectuates plans, policies and projects relating to water resources of the basin. A comprehensive plan for immediate and long-range development and uses is supplemented by an annual water resources program to meet estimated needs. All federal, state and local projects are cleared through the Commission and are not approved unless consonant with the comprehensive plan. Waters may be allocated among the signatory parties, and the Commission may impose conditions, obligations and requirements related thereto. Broad powers extend to all projects, research and changes for use of facilities, and include eminent domain. INCODEL has corporate powers with the commissioners acting as governing body and an executive director as administrator. Rules and regulations may be enforced under state penal sanctions and, in the absence of such statute, by a fine of from $50 t o $1000. (Douberley-Fla)
W69-09267

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501, art 4-7 (Supp 1966).

Descriptors: *River basin development, *Interstate compacts, *Water utilization, Pollution abatement, Water allocation (Policy), Flood control, Flood plains, Watershed management, Assessments, Cost-benefits analysis.
Identifiers: *Delaware River Basin, INCODEL.

INCODEL has the power t o develop water use and to control it by storage and release, without interference from signatories. Stream regulation may be provided, and the user benefitted thereby may be assessed for the improvements. The Commission cannot engage in the business of distributing water. It may investigate water pollution and operate projects to control and abate it. Rules or works may be established to protect public health or to preserve the waters, and orders may be issued to restrain violation, or INCODEL may file complaints with other pollution abatement agencies. The signatories agree to legislate to prevent pollution, and the compact will not interfere with state jurisdiction. INCODEL may plan, design, and operate projects for flood damage reduction, and set up standards for the use of land which is subject to flooding, notwithstanding inconsistent state regulations. It may establish encroachment lines on flood plains and is empowered to acquire this land to minimize flood hazards and to pose hazard warnings. INCODEL promotes watershed management, but is not to operate a facility if other agencies are available to do so. (Douberley-Fla)
W69-09303

WATERCOURSES--RECREATIONAL USES FOR WATER UNDER PRIOR APPROPRIATION LAW,
Willis H. Ellis.
Natural Resources Journal, Vol 6, No 2, p 181-185, Apr 1966. 5 p, 18 ref.

Descriptors: *Recreation, *Prior appropriation, Judicial decisions, Colorado, Water rights, Market value, Legislation.
Identifiers: *Colorado River Conservation District.

In 1935, the Colorado River Conservation District was legally granted the power to preserve sufficient waters for public recreation. However, when it tried to employ this power in 1965, the Colorado Supreme Court denied the District its water right. This article evaluates the action of the court and the provision for water recreation in Colorado. Western prior appropriation water law allows water rights to be sold apart from land. Ideally, this type of market allocates water to the highest economic uses available in the area. A major blind spot in this system is recreation, which has economic value for the entire area but has no one to bid for it. The District, originally empowered to set some waters

apart from the market, had insufficient guidelines for evaluating recreational uses and for selecting the amount and location of recreational waters. The article concludes that, to achieve a balanced water economy, the Colorado legislature should try again to legislate extra-market protection of some natural resources. This time, however, it should specify the means by which the agency is to choose the amount and location of the water to be withdrawn. (Gossen-Chicago)
W69-09324

DELAWARE RIVER BASIN COMPACT.

Del Code Ann tit 7, sec 6501 (Supp 1966).

Descriptors: *River basin development, *Interstate compacts, *Water utilization, Recreation, Hydroelectric plants, Withdrawal, Water shortage, Facilities, Hydroelectric power.
Identifiers: *Delaware River Basin, INCODEL.

INCODEL shall provide for the development of water related public sports and recreation facilities, but it shall operate such facilities only in the absence of other suitable agencies. It regulates contracts for recreation facility concessions and recommends standards for their operation. Waters may be impounded and facilities may be authorized or operated by the Commission for generation of hydroelectric power. Facilities may be provided for transmission of power, but INCODEL is not authorized to sell such power to consumers. Withdrawals and diversions may be regulated and areas designated as 'protected' or 'emergency' in the event of a water shortage threat. Use may be restricted to permits issued by the Commission. INCODEL sets up cost and reimbursement formulas for the parties and adopts an annual budget with payment schedules. It may also borrow money or issue tax-free bonds up to 6% interest. (Douberley-Fla)
W69-09326

Government roles in basic water research,
Colorada Univ., Boulder.
Gordon L. Allott.
Water Development Utilization, Conservation, 5th Western Resources Conference, Boulder, Colo, p 3-8, 1963.

Descriptors: *Interstate commissions, *Federal-state water rights conflicts, *State jurisdiction, Research and development, Water resources development.

Offered is an alternative to federal dominance in the field of water resources research. The author suggests the use of interstate compacts as bases for research and development. While these compacts have so far largely been concerned with division of the waters in interstate streams, the author contends that the mechanism of an interstate compact can be used for planning and administering comprehensive development of an interstate stream. An interstate river commission is seen as being a more appropriate agency to plan and administer river basin development than an all-federal agency because it maintains the decision-making process within the area where the decision must be made and because each state's water problems is somewhat different from the other state's water problems. (Starr-Chicago)
W69-09329

CERTAIN LOCAL PROVISIONS (FORMATION OF DRAINAGE DISTRICTS).
For primary bibliographic entry see Field 04A.
W69-09348

DRAINAGE DISTRICTS UNDER 1920 ACT.
For primary bibliographic entry see Field 04A.
W69-09361

THE STATE NAVIGATION SERVITUDE,
For primary bibliographic entry see Fiel d 04A.
W69-09377

GRANT OF EMINENT DOMAIN; EXCEPTION AS TO MILLS AND WATER POWERS.
NC Gen Stat sec 62-183 (1965).

Descriptors: *North Carolina, *Eminent domain, *Condemnation, *Public utilities, L egislation, Legal aspects, Compensation, Utilities, Competing uses, Electric power, Reservoirs, Water distribution (Applied), Ponds, Dams, Powerplants, Hydroelectric power, Diversion, Mills, Public benefits.

Certain public utilities are authorized to take such lands by eminent domain proceedings as may be necessary for the establishment of reservoirs, ponds, dams, works, railroads or powerhouses. In addition, there is granted the right to divert the water from such ponds or reservoirs and conduct the same by flume, ditch, conduit, waterway, or pipeline to the point of use for the generation of power. However, such diverted water must be returned to its proper channel after being used. There is no authorization to interfere with any mill or powerplant under construction or in present operation or to take water powers with adjacent land necessary for their development. Certain mills, except cotton mills, presently in operation may be condemned upon a showing that a hydroelectric plant will benefit the public more than the continued existence of the presently operating mill. (Childs-Fla)
W69-09378

FISH AND GAME LAWS--LOCAL AND SPECIAL PROVISIONS.
NJ Stat Ann secs 23:9-22, 23:9-23, 23:9-27 to 23:9-29, 23:9-33, 23:9-35, to 23:9-38 (1940); NJ Stat Ann secs 23:9-24 to 23:9-26, 23:9-30 to 23:9-32, 23:9-34 (Supp 1969).

Descriptors: *New Jersey, *Fish toxins, *Fish conservation, *Fish management, Reasonable use, Fishing, Trawling, Nets, Fyke nets, Gill nets, Trapping, Equipment, Sport fishing, Toxins, Chemicals, Pollutants, Gasoline, Oil wastes, Water pollution, Regulation, Fishing gear, Seasonal, Legislation, Legal aspects, Delaware River.
Identifiers: Penalties (Civil), Limits.

This is a comprehensive article detailing the line fishing and netting laws applicable to the waters of the Delaware River and its tributaries in the state of New Jersey. The article, in its various sections, establishes seasons for netting, handline fishing, and rod and line fishing for game and food fish. Bag limits, minimum sizes and maximum weights are prescribed for many varieties of fish, along with the setting of seasons during which various fish may be taken. Many of the sections within the article, particularly those dealing with the use of nets in taking fish, and closed laws for fishing, state that any person violating the provisions of a section shall be subject to fine and forfeiture of boats, nets and other appliances used. One section is specifically directed against the intentional or negligent placing of deleterious substances, such as would harm fish, into the waters covered by the article. (Blunt-Fla)
W69-09379

PORT DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09380

SANDERS V PLANT (SUIT TO DETERMINE WHETHER ACCRETIONS FOLLOW THE LAND CONVEYED).

204 SW 2d 323-326 (Ark 1947).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Riparian land, *Boundaries (Property), Real property, Riparian rights, Maps, Judicial decisions, State governments, Land tenure, Land forming, Land, Legal aspects, Ownership of beds, Relative rights.

Plaintiff brought action to have defendants enjoined from interfering with plaintiff's possession of certain lands. The court noted that the facts out of which this litigation arose were stated in a former appeal and would not be repeated. The issue involved was whether accretions to riparian land were conveyed with the land. The court unanimously accepted the general rule that a conveyance carries all the riparian rights of the land conveyed, including accretions. The court held that a separate conveyance of riparian rights is unnecessary unless there has been a severance of the riparian rights from the land conveyed. The evidence showed that there had been a separation of the accretions from the land. The court held that defendants had the original t itle to the accretions since plaintiff's deed from the state for the accretions was void because of the state's lack of power to make the sale. (Shevin-Fla)
W69-09381

JOHNSON CITY V MILLIGAN UTIL DIST (UTILITY DISTRICTS).
276 SW 2d 748-754 (Tenn Ct App 1954).

Descriptors: *Tennessee, *Public utilities, *Water supply, *Public utilities district, Cities, Water rates, Water conveyance, Pipes, Highways, Public benefits, Legal aspects, Judicial decisions, Local governments, Relative rights, Contracts.
Identifiers: Adverse possession, Injunctions.

The Utility District sought to take possession of a water l ine which the city had used to supply the area with water and which it claimed by adverse possession. The District was created by legislative act to furnish water to the area. The pipe had been built by a private landowner and used by the city, but a quit-claim deed had conveyed title to the district. The court determined that the city's right to use the pipe could not be construed as conferring upon it the right to use the line for its own purposes over the objection of the owner. Uncertainties and ambiguities in the language of the deed should be resolved in favor of the innocent purchaser. The court held that a purchaser would be justified in assuming that the use of the line by the ci ty was not inconsistent with the record of title. The court further stated that the city's use of the pipe showed an intention to treat the service not as that of a public utility but as being limited by private contract. The city did not act as a public utility and could therefore not question the sufficiency of notice of the hearing before the County Court or the validity of its decree. (Shevin-Fla)
W69-09382

UNITED STATES V 2,648.31 ACRES OF LAND (CONDEMNATION OF FLOWAGE RIGHTS).
For primary bibliographic entry see Field 04A.
W69-09383

RUSSELL FORK COAL CO V HAWKINS (LIABILITY FOR FLOODING CAUSED BY STRIP MINING).
For primary bibliographic entry see Field 04A.
W69-09384

CONSTRUCTION OF DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 04A.
W69-09385

ABANDONMENT OF HIGHWAY FOR CONSTRUCTION OF DAM; ACQUISITION OF LAND.
For primary bibliographic entry see Field 04A.
W69-09386

DRAINING LANDS.
For primary bibliographic entry see Field 04A.
W69-09387

DRAINING LANDS.
For primary bibliographic entry see Field 04A.
W69-09388

DRAINING LANDS.

Md Ann Code Art 25, secs 52 to 86 (1957).

Descriptors: *Maryland, *Drainage districts, *Drainage programs, *Surface drainage, Land reclamation, Controlled drainage, Drainage engineering, Flood control, Drainage systems, Legal aspects, Legislation, Construction, Ditches, Canals, Culverts, Local governments, Right-of-way, Easements, Condemnation.

Maryland's boards of county commissioners are authorized to establish public drainage associations in their respective jurisdictions, and to construct ditches, drains, and canals for the purpose of draining swampy or overflowed lands, or lands subject to overflow. Upon petition by affected landowners, the county board shall appoint a board of drainage viewers to study the feasibility of requests for drainage construction and to engage an engineer. The county commission may assess proportionate costs of the improvements against those persons who will derive benefit, or it may allocate general county funds for these projects. The board of drainage viewers then must report to the county commission regarding the practicality, public utility and expense of proposed improvements. The board of drainage viewers, upon approval of the project by the commission, selects a board of managers for the drainage district to be created. The managers are responsible for overseeing the drainage project and acquiring necessary easements and rights-of-way. Condemnation procedure is available to the board of managers if the owner of needed lands refuses to accept a duly authorized award of damages. (Kelly-Fla)
W69-09389

DUTIES OF DEPARTMENT OF CHESAPEAKE BAY AFFAIRS.
For primary bibliographic entry see Field 04A.
W69-09390

REGULATIONS IN COUNTY WATERS.
Md Ann Code art 66C, secs 269 thru 285 (1957).

Descriptors: *Maryland, *Fishing, *Nets, *Regulation, Local governments, Fish, Hunting, Riparian rights, Rivers, Streams, Bays, Tributaries, Permits, Legislation, Legal aspects, Fish conservation, Recreation, Fishing gear, Water resources development, Navigation.
Identifiers: Non-residents.

The statute sets forth specific regulations for various counties concerning water resources. These include primarily regulations on permissible times for fishing, places for fishing, and the means of fishing including the use of specific nets. The statute also covers licenses, non-resident requirements and hunting-fishing conflicts. Several county provisions protect riparian rights and navigation rights. Some of the sections contain specific sanctions. (Breeze-Fla)
W69-09391

CRABS, LOBSTER AND TERRAPINS.

Md Ann Code Art 66C secs 320, 322, 326, 330, 331, 332, 334 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Crabs, *Commercial shellfish, *Legislation, Permits, Boats, Nets, Rivers, Boundaries, Bays, Inlets (Waterway), Aquatic animals, Management, Regulation, Seasonal, Legal aspects, Shellfish.
Identifiers: Licenses, Limits.

It shall be unlawful for any person to catch hard-shell crabs in any waters of the state between January 1st and April 1st of every year. Any person desiring to catch crabs for commercial use must first obtain a license in the county in which he resides. The license shall be good for one year and will entitle the holder to catch crabs only in the county where the license was issued. Nonresidents of the state shall not be permitted to catch crabs for market from the waters of the state. It is unlawful to catch any hard-shell crabs which measure less than five inches across the shell from tip to tip of the spikes, any peelers measuring less than three inches, any soft-shell crab measuring less than three and one-half inches, or any fat crabs or crabs with paper shells. Any person violating any provision of this section shall be guilty of a misdemeanor. (Shevin-Fla)
W69-09392

DRAINAGE DISTRICT UNDER 1920 ACT.
For primary bibliographic entry see Field 04A.
W69-09393

DAMS A ND DRAINS.
For primary bibliographic entry see Field 04A.
W69-09394

NORTHEASTERN WATER AND RELATED LAND RESOURCES COMPACT.
For primary bibliographic entry see Field 06B.
W69-09395

DELAWARE WATER AND AIR RESOURCES COMM'N.
For primary bibliographic entry see Field 06B.
W69-09396

TAX DITCHES.
For primary bibliographic entry see Field 04A.
W69-09397

DELAWARE COMMISSION OF SHELL FISHERIES.

Del Code Ann tit 7, secs 1901-1911 (1953), as amended (Supp 1966).

Descriptors: *Delaware, *Commercial shellfish, *Legislation, *Administrative agencies, Oysters, Clams, Permits, Legal aspects, State governments, Regulation, Leases, Beds under water, Shellfish, Boating regulations, Conservation.

The Commission is composed of five members, one of whom is elected president and one who is appointed executive secretary by the governor. Other personnel may be appointed by the Commission as necessary to carry out its duties. The Commission has full control and direction of the shellfish industry and of the protection of shellfish in the state, with general authority to promulgate and enforce appropriate regulations. The Commission: (1) operates, improves, and preserves oyster and clam beds; (2) regulates boats, equipment, or vessels used in the shellfish industry; and (3) issues permits and establishes charges and fees for taking shellfish. Provisions are made for leasing areas of specified bays to residents for planting and catching oysters and clams. Leases may be granted only to residents individually who are acting on their own behalf. In the performance of its duties the Commission is empowered to examine sworn witnesses, who may be subpoenaed to appear and subject to perjury charges for false testimony. A final section prohibits vacuum or suction mechanical devices for taking or catching shellfish. (Douberley-Fla)
W69-09398

ALLEN V NEW YORK STATE WATER RESOURCES COMM'N (DAMAGE FROM DAM CONSTRUCTION).
For primary bibliographic entry see Field 04A.
W69-09399

GRATHWOHL V HIWAY WONDERLAND INC (FLOOD DAMAGE FROM LOWER RIPARIAN DAM).
For primary bibliographic entry see Field 04A.
W69-09400

BROADWAY LAKE COMM'N, ANDERSON COUNTY.
For primary bibliographic entry see Field 06B.
W69-09401

RELEASE TO PARK COMMISSIONERS OF SHORE LANDS.
Ill Ann Stat ch 105, sec 325 (Smith-Hurd 1952).

Descriptors: *Illinois, *Riparian lands, *Riparian rights, *Local governments, Legislation, Legal aspects, Water law, Water policy, Water utilization, Reclamation, Public lands, Recreation, Parks, Administrative agencies, Recreation facilities, Land use, Cities, Beds under water.
Identifiers: *Public waters, Submerged lands.

When any city or town acquires control over lands bordering public waters and the riparian rights appurtenant thereto, it may grant such lands or rights for park purposes to the appropriate park commissioners or park board having control of any park within that city or town. Such city or town may also make agreements with such commissioners for the reclamation for park purposes of submerged lands under the public waters adjacent thereto provided that said commissioners never grant such lands to private parties. (Johnson-Fla)
W69-09402

OPEN SEASONS FOR, LIMITS FOR, AND METHODS OF TAKING CERTAIN WATER LIFE.

Ill Ann Stat ch 56, secs 163-191.7 (Smith-Hurd 1967), as amended, (Supp 1969).

Descriptors: *Illinois, *Fishing, *Wildlife conservation, *Regulation, Legislation, Wildlife, Fish, Wildlife management, Trout, Frogs, Bass, Fish conservation, Fishing gear, State governments, Nets, Shellfish, Crayfish, Seasonal, Legal aspects, Control, Mussels.
Identifiers: Limits.

Daily limits are set up for the taking of trout, bass, pickerel, and pike. Certain fish species may only be taken by hook and line. The open season and daily limits for bullfrogs are set. The method of taking certain species is provided for and other methods are prohibited. Ice fishing may only be done in the prescribed manner. Snag lines and snag poles are unlawful. Only two hooks may be used on any fishing pole or line. Certain fish may not be released in state waters without permission from the state. Snares, spears, and artificial lights are prohibited for the purposes of taking fish. Live carp and lamprey eels may not be used as bait. Firearms, airguns or gas guns may not be used to take bullfrogs. Certain fish may not be taken by pitchfork, spear gun, gig, or bow and arrow. A hook net turtle trap is unlawful to use if it does not meet certain dimensions. Nonresidents may not take turtles or crayfish by any means. Mussels may not be taken by mechanical devices. Fishing lines may not be attached to any portion of a tree other than the main trunk. (Heckerling-Fla)
W69-09403

CONTROL OF CERTAIN SALVAGE OPERATIONS.
For primary bibliographic entry see Field 04A.
W69-09404

STATE BOARD OF HEALTH SEWER SYSTEMS AND SEWAGE TREATMENT PLANTS.
For primary bibliographic entry see Field 05D.
W69-09405

ROCKY MOUNTAIN POWER CO V FEDERAL POWER COMM'N (FEASIBILITY INFORMATION REQUIRED BEFORE AUTHORIZATION OF POWER PLANT).

409 F2d 1122-1130 (DC Cir 1969).

Descriptors: *Judicial decisions, *Administrative decisions, *Hydroelectric plants, *Hydroelectric project licensing, Administrative agencies, Federal Power Act, Colorado, Electric power production, Electric power industry, Legislation, Cost analysis, Costs, Financial analysis, Financial feasibility, Financing, Marketing, Power marketing, Planning, Management.
Identifiers: Federal Power Commission.

Petitioner filed an application for authorization to construct and operate a hydroelectric project in January of 1961. A month later the Commission informed petitioner that it was insufficiently detailed in respect to provisions for financing the project and for marketing its output. At petitioner's repeated requests for extensions, the application was held pending for six years awaiting the necessary proof of economic and financial feasibility. At the hearing to consider the application, petitioner had produced no contracts for the sale of power. Since no financing plan could be compiled without prospective buyers, the application was dismissed without prejudice. Upon review of the Commission's order, the court affirmed the dismissal. Noting that the Commission had the power to require petitioner to submit reasonably adequate information denoting financial feasibility of the project, the court held that the dismissal was not unreasonable in light of petitioner's failure to show the project's feasibility. Since the Commission's order allowed petitioner to re-apply when the necessary financial information became available, it was unnecessary to hold the application pending any longer. (Douberley-Fla)
W69-09406

LOUISVILLE WATER CO INC V BOSLER (TORT LIABILITY FOR WATER DAMAGES FROM BROKEN CONDUITS).
For primary bibliographic entry see Field 04C.
W69-09407

RICE V OAKLAND COUNTY DRAIN COMM'R (ASSESSMENTS MUST BEAR RELATIONSHIP TO BENEFITS).
For primary bibliographic entry see Field 06C.
W69-09408

BARTLETT V ST ALKER LAKE SPORTSMEN'S CLUB (DEDICATION OF EASEMENT TO NON-NAVIGABLE LAKE).

168 NW 2d 356-361 (Minn 1969).

Descriptors: *Minnesota, *Easements, *Non-navigable waters, Access routes, Lakes, Riparian rights, Hunting, Game birds, Waterfowl, Right-of-way, Condemnation, Legal aspects, Judicial decisions, Remedies, Public rights, Public benefits, Relative rights, Riparian rights, Riparian land.
Identifiers: Dedication, Injunction (Prohibitory).

Plaintiffs owned a shallow, marshy, non-navigable lake and the lands surrounding it. In 1967, plaintiffs brought action to enjoin trespass upon and over one of the lots bordering on the lake. In 1954, a previous owner of this lot had granted to the public the right to hunt on the lake, insofar as he possessed that right, and had conveyed a perpetual easement across a portion of his lot to allow access. The following year a local sportsmen's club had bul ldozed an access route across this easement. The trial court found that the grant of hunting and easement rights constituted an offer to dedicate and that the clearing of an access route to the lake and the use of the land by hunters was sufficient to constitute acceptance. Thus defendants had not trespassed as they had legal right to be on the land. Plaintiff appealed. The supreme court affirmed, accepting the trial court's finding that a dedication and an acceptance had occurred. It held that riparian rights to the use of the entire overlying water exist even on a non-navigable lake. It also found that while the state cannot condemn access to a private non-navigable lake, access may be accepted when offered by the riparian owner. (Gabrielson-Fla)
W69-09409

DITTMAN V NAGEL (BREACH OF WARRANTY OF WELL WATER).
For primary bibliographic entry see Field 05F.
W69-09410

AALSBURG V CASHION (TITLE TO LAND CREATED BY ACCRETION).

167 NW 2d 902-904 (Ct App Mich 1969).

Descriptors: *Michigan, *Boundary disputes, *Accretion (Legal aspects), *Boundaries (Property), Judicial decisions, Lake shores, Land tenure, Real property, Legal aspects.
Identifiers: Adverse possession.

Third party defendant MacGregor sought a rehearing in the Michigan Court of Appeals on the question of whether title to certain lands created by accretion inured to him by adverse possession. The court of appeals affirmed its earlier holding that it was not adverse possession but was acquiescence. The court held that the evidence showed no definite boundary lines but only a 'live and let live' course of conduct. The court found that both parties had been using the same land over the years. Such usage of the land prevented any inuring of title by adverse possession. (Gadd-Fla)
W69-09411

IMPERIAL REFINERIES OF MINNESOTA INC V CITY OF ROCHESTER (ASSESSMENT FOR SEWER AND WATER IMPROVEMENTS).
For primary bibliographic entry see Field 06C.
W69-09412

TOWNSHIP OF GROSSE ILE V DUNBAR AND SULLIVAN DREDGING CO (RIPARIAN RIGHTS ARE SUBJECT TO PUBLIC RIGHTS).

167 NW 2d 311-316 (Ct App Mich 1969).

Descriptors: *Michigan, *Public rights, *Benefits, *Dikes, Landfills, Permits, Legislation, Riparian rights, Dredging, Rivers, Navigable rivers, Navigable waters, Islands, Channel improvement, Ownership of beds, Legal aspects, Judicial decisions, Remedies, Zoning.
Identifiers: Public trusts, Nonconforming use, Injunctions (Prohibitory).

Plaintiffs brought suit to enjoin defendant's dike and fill operation off an island in the Detroit River claiming that it violated a city zoning ordinance and impaired the public trust, the wildlife habitat and the public use of the area. The trial court granted an injunction on both of these theories and defendant appealed. The court of appeals affirmed. As to the violation of the city zoning ordinance, the trial court's finding that the dike and fill operation was not carried on to a sufficient extent prior t o the ordinance adoption to be deemed a nonconforming use was upheld. In regard to the violation of the public trust, the court noted that the title of a riparian owner in the bed of a navigable river is subject to a public trust for the preservation of the various public rights. Here, there was sufficient evidence to support the trial judge's conclusion that defendant's operation created a real and substantial impairment of the public's use of the ar for hunting, fishing, and boating. (Gabrielson-Fla
W69-09413

BATTJES BUILDERS V BOUMA (COUNT DRAIN PROJECT).
For primary bibliographic entry see Field 04A.
W69-09414

FOND DU LAC METROPOLITAN SEWERAG DISTRICT V CITY OF FOND DU LA (ESTABLISHING A SEWAGE DISTRICT).
For primary bibliographic entry see Field 05G.
W69-09415

PEOPLE OF THE STATE OF MICHIGAN JONDREAU (STATE JURISDICTION OVER I DIANS ON THE GREAT LAKE).

166 NW 2d 293-295 (Ct App Mich 1969).

Descriptors: *Michigan, *Fish conservation, *Sta governments, *Boundaries, Judicial decisio Legal aspects, Lake trout, Fishing, Indian reserv tions, Treaties, Great Lakes, Beds, Federal-sta water rights conflict, Federal jurisdiction, State risdiction, Regulation.
Identifiers: Keewenaw Bay, Chippewa tribe, Imm nity, Servitude.

The defendant, a Chippewa Indian, had been rested for illegal possession of lake trout. Defe dant claimed immunity from state conservati regulations because of a federal treaty. The cou found that the defendant had caught the fish Lake Superior, which was not on reservation lar Submerged lands of the Great Lakes adjacent Michigan could not have been granted the India since they were owned by the state before t treaty with the Indians. The court described t question to be whether an Indian was subject state game laws on non-reservation land despite f ederal treaty. The court decided that the def dant was subject to state game laws. The court lied on United States Supreme Court decisio which held that treaty provisions did not preclu state fishing regulations in the interests of conse vation. The court held that the regulation was va when a reasonable and necessary exercise of poli power was used, not discriminating against the dians. The court reconciled the regulations with t federal treaty in that the federal treaty only grant a privilege subject to the states' power of a propriate regulation. (Gadd-Fla)
W69-09416

LAY OUT OF CLASS IV, V, VI HIGHWAYS.

NH Rev Stat Ann sec 234:48 (1964).

Descriptors: *New Hampshire, *Highways, *Bou daries (Property), *Highway effects, Bounda disputes, Highway construction, Bridge constru tion, Bodies of water, Local governments, Legis tion, Legal aspects, Cities.

When a highway is laid out across a body of wa which constitutes the boundary between t towns, the commissioners shall determine the li to which each town shall construct, such li thereafter constituting the boundary between t towns at the point. (Kahle-Fla)
W69-09417

LIABILITIES OF TOWNS FOR DAMAG CAUSED BY INADEQUATE BRIDGES OR CU VERTS.
For primary bibliographic entry see Field 04C.
W69-09418

WATER SUPPLY; SANITATION.
For primary bibliographic entry see Field 04A.
W69-09419

WATER POLLUTION.
For primary bibliographic entry see Field 05G.
W69-09420

LAKE CALUMET HARBOR.
For primary bibliographic entry see Field 04A.
W69-09421

LEVEL OF LAKE MICHIGAN.
For primary bibliographic entry see Field 04A.
W69-09422

FEDERAL WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-09423

CHICAGO PARK DISTRICT AND CONSTRUCTION OF HARBOR FOR RECREATIONAL PURPOSES.
For primary bibliographic entry see Field 04A.
W69-09424

PARKS: DRIVEWAYS AND BOULEVARDS.
Ill Ann Stat ch 105 secs 125-129 (Smith-Hurd 1952).

Descriptors: *Illinois, *Recreation facilities, *Parks, *Road construction, Access routes, Land use, Riparian rights, Scenic highways, Legal aspects, Legislation, Beds under water, Right-of-way, Public lands, Eminent domain.

The board of park commissioners having jurisdiction may extend a highway which connects to a public park bordering on public waters a distance of two hundred feet over the bed of such public waters. However, there must be no interference with commercial navigation. A board of park commissioners contemplating an extension of this type must prepare plans, make costs estimates, and secure the consent of any affected riparian owners. The submerged lands lying between the shore and the inner line of the extended highway will be appropriated by the board. The title to the extended boulevard or highway will vest in the board and will become part of the public park. (Kelly-Fla)
W69-09425

OPERATION AND MAINTENANCE OF HARBORS FOR RECREATIONAL PURPOSES.
For primary bibliographic entry see Field 04A.
W69-09426

WATERCRAFT, RAFTS--PROCEEDINGS ON TAKING UP.
Ill Ann Stat ch 50, sec 21 (Smith-Hurd 1966).

Descriptors: *Illinois, *Boats, *Regulation, *Lumber, Value, Legislation, Watercourses (Legal), Floating, Legal aspects, Water law.
Identifiers: Rafts, Ferries, Flat boats.

If any person stops or takes up any keel or flat boat, ferry flat, batteau, pirogue, canoe, or other vessel or watercraft found adrift on any watercourse within the state and the same shall be valued at $15 or more, he must, within five days, go before a judge of the proper county and make an affidavit describing such vessel. He must also detail the place where the vessel was found and describe the cargo aboard if any was found. (Shevin-Fla)
W69-09427

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09428

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09429

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09430

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09431

SURFACE WATER PROTECTION DISTRICTS.
For primary bibliographic entry see Field 04A.
W69-09432

WOLF CREEK COLLIERIES CO V DAVIS (DAMAGE TO WATER WELL BY BLASTING OPERATIONS).

441 SW 2d 401-403 (Ky 1969).

Descriptors: *Kentucky, *Water loss, *Water wells, *Mining, Legal aspects, Judicial decisions, Water rights, Water sources, Water levels, Coal mines, Explosives, Underground streams, Underground, Explosions, Damages, Costs, Boundaries (Property), Water supply, Water table, Relative rights, Mining engineering, Barriers, Diversion, Channels, Land tenure, Reservoirs, Deep wells.
Identifiers: *Water depletion.

Plaintiff recovered $2500 as damages for depletion of a water well on his land. The jury determined such damages to have been caused by blasting in defendant's underground coal mine. On appeal the court granted defendant's motion for a mistrial based upon improper remarks by appellee's counsel. The court went on to consider the issue of liability which it felt would arise at a new trial. The court stated that liability from blasting does not rest on negligence and the only issues to be submitted to the jury are causation and damages. The court found that defendant's evidence that the mine was dry and that there were no cracks in the roof of the mine was not conclusive to show a lack of disturbance of barriers or channels under appellee's land such as would divert a watercourse or lower the water table. The court found that the plaintiff's evidence was sufficient to create a jury question. The judgment was reversed with directions for further proceedings in conformity with this opinion. (Shevin-Fla)
W69-09433

PURIFICATION OF WATERS--DRAINAGE OF PONDS.
For primary bibliographic entry see Field 05G.
W69-09434

RE-LOCATING WATERCOURSES.
For primary bibliographic entry see Field 04A.
W69-09435

HARBORS FOR RECREATIONAL USE.
For primary bibliographic entry see Field 04A.
W69-09436

WATERCOURSES, CANALS, WHARVES, AND LEVEES.
For primary bibliographic entry see Field 04A.
W69-09437

CONSTRUCTION OF WELLS AND WATERWORKS.
For primary bibliographic entry see Field 04B.
W69-09438

REGULATION AND RESTRICTION IN THE LOCATION AND USE OF STRUCTURES.
For primary bibliographic entry see Field 04A.
W69-09439

DISCHARGE OF SEWAGE INTO OPEN DITCHES ALONG STREET OR HIGHWAY.
For primary bibliographic entry see Field 05G.
W69-09440

JONES V WELLMAN (BOUNDARY DISPUTE).

223 So 2d 572 (4th DCA Fla 1969).

Descriptors: *Florida, *Boundaries (Property), *Boundary disputes, *Streams, High water mark, Land, Real property, Land tenure, Legal aspects, Judicial decisions.
Identifiers: *Meander line.

Plaintiff brought an action for ejectment and from a ruling for defendant, took this appeal. Plaintiff contended that the correct boundary of his property was the high water mark of Taylor Creek and that all land between the meander line and the creek was his property. Defendant contended that the correct boundary was the meander line and that plaintiff was not entitled to the land in question. The appellate court held that the evidence supported the verdict for the defendant rendered by the jury and affirmed the decision. (Shevin-Fla)
W69-09441

GREAT LAKES BASIN COMPACT.
For primary bibliographic entry see Field 06B.
W69-09442

PRIVATE FISH HATCHERY.

Iowa Code Ann sec 109.54, 109.64 (1949).

Descriptors: *Iowa, *Fish hatcheries, *Regualtion, Breeding, Stocking, Fish harvest, Migration, Legislation, Natural streams, Buffalo fishes, Carp, Size, Fish stocking, Commercial fish, Commercial fishing, Permits, Legal aspects.
Identifiers: *Private waters, *Public waters, Propagation.

It shall be unlawful to operate a private fish hatchery or propagate fish native to Iowa in private waters without first obtaining a private fish hatchery license. Licenses shall not be issued to any hatchery that may be stocked with fish from public waters by overflow or natural migration. All fish acquired and distributed by private hatcheries must comply with state size and limit laws. Only native fish may be sold for stocking purposes within the state. Breeding stock must be obtained from licensed private fish hatcheries in the state or lawful sources outside the state. Fish lawfully taken by commercial fishermen may be held, fed and sold under private fish hatchery licenses. (Holt-Fla)
W69-09443

ANDERSEN V SCHMIDT (EASEMENT OVER LAND TO WATER'S EDGE).

168 NW 2d 437-439 (Ct App Mich 1969).

Descriptors: *Michigan, *Lake shores, *Easements, *Land tenure, Riparian land, Islands, Lakes, Shores, Boating, Land use, Legal aspects, Judicial decisions, Water law, Road construction, Boat-launching ramps, Docks, Marinas, Real property, Access routes.
Identifiers: *Boat house, Ingress, Egress.

One of defendants' predecessors in title granted to a predecessor of plaintiffs the right of ingress and egress over his land in order to get to a boathouse on the shore of Silver Lake. The agreement was recorded and appears in plaintiffs' chain of title. Plaintiffs own an island in the lake. The boathouse deteriorated and collapsed by 1960. Plaintiffs brought this action requesting the court to find an easement appurtenant over the defendants' land to the water's edge of Silver Lake. Judgment was granted for defendants and plaintiffs appealed. Plaintiffs contended the agreement created a per-

petual easement which would allow them to complete a road to the lake and construct a dock and other buildings for their use in getting to their island. The lower court held that when an easement is granted for a particular purpose it terminates when the purpose for which it was granted is abandoned. The appellate court upheld this determination and further found that the boathouse was essential to the purpose of the easement. Thus the collapse of the boathouse made the purpose of easement hopeless and impossible. The determination of the trial court was affirmed. (Shevin-Fla)
W69-09446

6F. Nonstructural Alternatives

SPECIAL FLOOD HAZARD INFORMATION, SHOAL CREEK, JOPLIN, MISSOURI.
Corps of Engineers, Tulsa, Okla.

Corps Eng Flood Plain Rep, Mar 1969. 5 p, 2 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Missouri, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Joplin (Mo), Standard project flood, Intermediate regional flood.

Flooding of Shoal Creek, Joplin, Missouri is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-09259

OPTIMIZING INVESTMENT IN FLOOD CONTROL AND FLOOD PLAIN ZONING,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Water Resources Research, Vol 5, No 4, p 761-766, Aug 1969. 5 p, 2 tab, 2 ref.

Descriptors: *Optimization, *Flood plain zoning, Benefit-cost ratio, Economics, Flood control, Non-structural alternatives.
Identifiers: Project-induced economic growth.

Recent governmental actions have accentuated flood plain zoning as an alternative to structural flood control. Optimization of investment between these alternatives requires consideration of project-induced development (economic development which would not occur if the project were not built) and site income (the return to the owner of new construction in the flood plain net of the cost of their development). These concepts are used to develop quantitative criteria applicable to determining to what extent zoning is practicable and to determining a correct benefit-cost ratio for the optimum solution. Results indicate that previously existing methods that do not take account of damages to project-induced growth may give unduly high benefit-cost ratios. It should normally be expected that a combination of flood control and zoning will be most productive. (Marriott-Chicago)
W69-09330

6G. Ecologic Impact of Water Development

PHYSICAL IMPLICATIONS OF LARGE-SCALE WATER TRANSFERS,
California Univ., Richmond. Sanitary Engineering Research Lab.
Percy Harold McGauhey.
IN W.G. McGinnies and B.J. Goldman, Eds., Arid Lands in Perspective, p 358-363, University of Arizona Press, Tucson, 1969. 6 p, 1 tab, 5 ref.

Descriptors: *Water transfer, *Evaluation, *Interbasin transfer, Arid lands, Arid climates, California, Export, Import, Municipal water, Water conveyance, Water distribution (Applied), Dissolved solids, Irrigation water, Impared water quality, Water pollution, Administration, Southwest U.S., Arizona, Irrigation programs, Planning, Riparian rights, Human population, Social impact.
Identifiers: North American Water and Power Alliance.

It is characteristic of most every effort man has made to shape his environment that he has viewed his objective more as an isolated task rather than as one facet of a complex system existing in a dynamic equilibrium, often with negative results. This paper explores one facet of such a task: physical implications of large-scale water transfers. The development of natural transfer systems, rivers, is traced, including riparian ownership, quality, quantity, and return-waters. Man-made transport systems are termed 'rivers in reverse'; problems of dissolved solids build-up, seepage, and riparian ownership are discussed. The physical results of long-term large-scale use of imported water in arid lands are considered. Several past projects are reviewed. The physical and social effects of not employing large-scale water transfers are explored. Objections to such schemes as the North American Water and Power Alliance are listed. The nature of the transfer systems involved may cause government, for good or evil, to guide land use planning and economic growth, control patterns of urbanization and meet some of man's recreational needs. (See W69-09210). (Sherbrooke-Ariz)
W69-09217

SOCIAL AND ECOLOGICAL IMPLICATIONS OF WATER IMPORTATION INTO ARID LANDS,
Texas Technological Coll., Lubbock.
Gerald W. Thomas, and Thadis W. Box.
IN W.G. McGinnies and B.J. Goldman, eds., Arid Lands in Perspective, p 363-374, University of Arizona Press, Tucson, 1969. 12 p, 7 fig, 38 ref.

Descriptors: *Water transfer, *Social impact, *Ecology, *Arid lands, Mosquitoes, Distribution patterns, Diversion losses, Fish management, Interbasin transfers, Land clearing, Water demand, Wildlife management, Long-term planning, Coordination, Decision making, Water resources development, Social aspects, Estuarine environment, Microenvironment, Terrestrial habitats, Wildlife habitats, Irrigation effects, Aquatic habitats, Balance of nature.
Identifiers: California State Water Project, Texas Water Plan, North American Water and Power Alliance, Australian Snowy Mountain, G reat Lakes Plan for the Amazon, Aswan High Dam.

Large-scale water movement to the arid zones appears to be inevitable. Pressures for these projects increase because they are technologically possible, economically possible, and may be necessary for society to survive and grow. Several examples of large scale water projects are presented; California State Water Project, Texas Water Plan, North American Water and Power Alliance, Australian Snowy Mountain, Great Lakes Plan for the Amazon, Aswan High Dam. The social and ecological implications of some of these projects are considered. Changes in fish species and populations, bird migratory routes and densities and terrestrial habitat destruction are documented. Wider mass use of insecticides, increases in mosquito populations, and alteration of microhabitats are to be expected. The authors urge that sound ecological studies be incorporated in the initial planning for large scale water movement. It is highly possible that ecological understanding could be the major factor in decision-making -- even overriding political, social or economic considerations. No example of good advanced planning involving the entire scientific community could be found. (See W69-09210). (Sherbrooke-Ariz)
W69-09218

CHEREVKOVSKOY WATER-MEADOWS OF THE NORTH DVINA VALLEY. I. NATURAL CONDITIONS (RUSSIAN),
Leningrad State Univ. (USSR).
For primary bibliographic entry see Field 04D.
W69-09292

07. RESOURCES DATA

7A. Network Design

THE RAINFALL MEASUREMENT PROBLEM,
Hydrological Research Unit, Wallingford (England).
John C. Rodda.
Symp on Geochem, Precipitation, Evaporation, Soil-Moisture, Hydrom, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 78, p 215-231, 1968. 17 p, 10 fig, 6 tab, 23 ref.

Descriptors: *Networks, *Rain gages, *Distribution patterns, Hydrologic data, Instrumentation, Rainfall disposition, Estimating.
Identifiers: *Rain gage location, *United Kingdom, *Wallingford (U.K.), Error analysis.

Rainfall measurements are made in standard gages installed with their rims at a fixed distance above the ground surface, but they are assumed to measure the rain actually reaching the ground. Because the quantity of rain reaching the ground is invariably greater than the amount recorded by a standard gage, there is a systematic error in a measurement of rainfall made in the conventional way. At Wallingford, Berkshire, United Kingdom, over a period of 5 years, the total rainfall measured by a gage level with the ground surface was 6.6% greater than that recorded by a gage at the standard height of 1 ft, some 16 ft away. The difference between the gages had a summer minimum and a maximum in the winter and early spring, and there was considerable daily variation. Measurements of wind speed and angle of rainfall were used to study these differences, but without complete success. No patterns were found in the distribution of rainfall across the site. Splash was considered more likely to affect the standard gage. Although the diff erences in catch could not be entirely explained, it was concluded that the ground level gage would produce measurements nearest the real rainfall. It was recommended that ground level rain gages should be installed alongside standard gages for research purposes, especially in experimental and representative basins. (Knapp-USGS)
W69-09175

7B. Data Acquisition

APPLICATION OF DEEP ELECTRICAL SOUNDINGS FOR GROUNDWATER EXPLORATION IN HAWAII,
Geological Survey, Denver, Colo.
Adel A. R. Zohdy, and Dallas B. Jackson.
Geophysics, Vol 34, No 4, p 584-600, Aug 1969. 17 p, 19 fig, 1 tab, 20 ref.

Descriptors: *Electrical studies, *Geophysics, *Groundwater, *Hawaii, Surveys, Resistivity, Electrical resistance, Rock properties, Water levels, Aquifers, Basalts, Saline waters-freshwater interfaces, Exploration.
Identifiers: Groundwater prospecting, Electrical sounding.

Resistivity soundings, using Schlumberger and equatorial dipole electrode configurations, were made on the islands of Oahu and Hawaii to determine the applicability of direct current resistivity methods for locating freshwater aquifers in the State of Hawaii. The soundings were made on the

northwestern part of the island of Oahu near the town of Waialua and on the island of Hawaii of the 'saddle' area near Pohakuloa and Humuula. Interpretation of 32 sounding curves obtained on the island of Oahu indicates that it is possible to correlate 5 stratigraphic units underlain by a vesicular basalt basement and that the determination of the approximate depth to the freshwater-saline-water interface within the basalt is feasible. Near the town of Waialua the aquifer is a coral zone as well as parts of the weathered vesicular basalt basement. On the island of Hawaii, near Pohakuloa, an exploratory well drilled in basalt to a depth of 1001 ft prior to the resistivity survey proved to be dry. Interpretation of 13 deep soundings made with Schlumberger and equatorial arrays suggests that the minimum depth to a conductive layer, which may represent basalt saturated with freshwater, is about 2700 ft below land surface. The groundwater appears to be dike-impounded. (Knapp-USGS)
W69-09133

COMPUTERIZED TEMPERATURE DECAY--AN ASSET TO TEMPERATURE LOGGING,
Society of Petroleum Engineers of AIME, Dallas, Tex.
R. D. Cocanower, Billy P. Morris, and Mat Dillingham.
J Petrol Technol, p 933-941, Aug 1969. 9 p, 8 fig, 15 ref.

Descriptors: *Geophysics, *Surveys, *Temperature, *Injection wells, Oil wells, Flooding, Oil reservoirs, Permeability, Secondary recovery (Oil), Storage, Gases.
Identifiers: Injection temperature surveys.

By measuring borehole temperature change rates after shut-in and using computer extrapolation of the data, zones of injection may be defined precisely. Methods of calculation are illustrated with examples and results are presented in graphs and charts. (Knapp-USGS)
W69-09138

SATELLITE APPLICATIONS TO SNOW HYDROLOGY, 1968,
Environmental Science Services Administration, Rockville, Md.
Robert W. Popham.
World Meteorol Organ-Int Hydrol Decade Rep No 7, 1968. 10 p, 8 ref, 1 append.

Descriptors: *Remote sensing, *Satellites (Artificial), *Snow surveys, Snowpacks, Snowmelt, Snowfall, Mapping, Surveys, Snow management, Radar, Photography, Data collections, Telemetry, Terrain analysis.
Identifiers: Satellite snow-measurement techniques.

The possibility of using satellite-borne remote sensing techniques to determine the areal extent and other characteristics of snow cover has been under investigation for a number of years. During the past 3 years TIROS, NIMBUS and ESSA meteorological satellite photographs have been used operationally by river forecast offices in the western United States to estimate snow cover. These and other activities suggest that remote sensing from satellites can be applied practically to snow hydrology. Satellite snow-surveillance activities are summarized, existing and proposed satellite instrumentation applicable to snow hydrology are reviewed, and areas where further efforts could yield significant results in this field are suggested. (Knapp-USGS)
W69-09178

FRESH-WATER SPRINGS OF HAWAII FROM INFRARED IMAGES,
Geological Survey, Washington, D.C.
William A. Fischer, Dan A. Davis, and Theresa A. Sousa.
Geol Surv Hydrol Invest Atlas HA-218, 1 sheet, 1966. Text, 28 fig, 1 plate, 1 tab, 2 ref.

Descriptors: *Remote sensing, *Springs, *Discharge (Water), *Hawaii, Infrared radiation, Mapping, Aerial photography, Cold springs, Fresh water, Surveys.
Identifiers: Hawaii County (Hawaii), Radiometry.

To study spring discharges into the ocean from the island of Hawaii, infrared images showing water temperatures in the ocean near the island were obtained in 1968. Positive prints from negatives made with electro-optical scanning radiometers show differences in apparent temperatures in shades of gray. Spring water shows on the prints because it is cooler than ocean water. Most discharge of water from Hawaii is in sea-level springs. Streamflow is intermittent because of extremely rapid infiltration into highly permeable volcanic rocks. Spring locations, areas of thermal anomalies, and descriptions are tabulated. Aerial photographs and radiographic prints are marked to show thermal anomalies and spring locations. (Knapp-USGS)
W69-09199

AIRBORNE REMOTE SENSING FOR GROUNDWATER STUDIES IN PRAIRIE ENVIRONMENT,
Department of Agriculture, Edmonton (Alberta). Water Resources Div.
M. E. Chase.
Can J Earth Sci, Vol 6, No 4, Part 1, p 737-741, Aug 1969. 5 p, 4 fig, 9 ref.

Descriptors: *Remote sensing, *Aerial photography, *Infrared radiation, *Groundwater movement, Glacial drift, Soil moisture, Vegetation effects, Water temperature.
Identifiers: *Canada, Alberta.

A deficiency of groundwater in an area of prairieland in southern Alberta prompted a survey by airborne remote sensors. Panchromatic and black and white true infrared photography coverages were obtained and studied, but were found to be of limited value. An infrared scanning survey, using the 2.5-5.6 micron band was flown at the same time and found to be more informative. Conditions of ground truth were not ideal, making the results less conclusive than desired. Till covers most of the area, with lake deposits on the eastern section. Soil moisture changes were registered on the imagery, but the depths of overburden to which these changes were recorded on the surface are unknown, due to the condition variations between the time of the survey and the drilling. Vegetation, surface water, soil moisture, and saline sloughs were found to have the strongest thermal signatures. Problems encountered in the survey are discussed and recommendations to eliminate them are given. (Knapp-USGS)
W69-09239

SOME GUIDELINES FOR REMOTE SENSING IN HYDROLOGY,
Geological Survey, Washington, D.C.
Charles J. Robinove, and Daniel G. Anderson.
Water Resources Bull, Vol 5, No 2, p 10-19, June 1969. 10 p, 4 fig, 9 ref.

Descriptors: *Remote sensing, *Surveys, *Hydrologic data, *Reviews, Aerial photography, Infrared radiation, Instrumentation, Mapping, Photogrammetry, Photometry, Terrain analysis, Telemetry, Satellites (Artificial).
Identifiers: Infrared imagery, Satellite photography.

Remote sensing in the field of hydrology is beginning to be appied to significant problems, such as thermal pollution, in many programs of the Federal and State Governments as well as in operation of many private organizations. A discussion of the subject is given to guide the hydrologist to a better understanding of how he may collect, synthesize, and interpret remote sensing data. The techniques discussed include color aerial photography, infrared aerial photography, infrared imagery and photogrammetry. Data reduction methods and equipment are briefly outlined. Like any other new technique remote sensing will eventually find its place in the resource disciplines. It will also have its pitfalls, many of which probably can be avoided by proper planning of projects and through knowledge of the capabilities of remote sensing systems. It is the task of the hydrologist, at this time, to assess his needs for data, to match them with the capabilities of remote sensing systems and the presently used data collection systems, and use them in the most beneficial way. (Knapp-USGS)
W69-09241

METEOROLOGICAL EXPERIMENTS FOR AUTOMATED SATELLITES,
National Aernautics and Space Administration, Washington, D.C. Dept. of Meteorology and Soundings.
William C. Spreen.
Water Resources Bull, Vol 5, No 2, p 20-35, June 1969. 16 p, 5 fig, 1 tab, 15 ref.

Descriptors: *Satellites (Artificial), *Meteorology, *Remote sensing, Surveys, Synoptic analysis, Weather forecasting, Aerial photography, Solar radiation, Winds, Clouds, Cloud cover, Energy budget.
Identifiers: Meteorology satellites.

The satellites used in meteorology include TIROS, ESSA Nimbus, and Applications Technology Satellite (ATS). The first three operate in the orbital altitudes of about 1000 to 1200 km while the fourth, ATS, is at geosynchronous altitude of 36,000 km. Cloud cover is observed operationally from low orbit and experimentally from synchronous altitude. Wind velocity has been inferred from the frequent cloud cover pictures taken by ATS, and satellite-balloon systems are being developed which will locate and track constant-density level balloons for determining wind flow. Spectrometers and radiometers operating in the electromagnetic spectral region from the ultraviolet to the microwave region are being developed to quantitatively measure temperature, water vapor, density and wind profiles. These will furnish data for the development and testing of atmospheric models for numerical prediction. In addition, experiments are being developed to measure ozone, other constituents of the air, solar energy, surface conditions, heat balance, and other atmospheric attributes which effect the structure and dynamics of the atmosphere. (Knapp-USGS)
W69-09242

TIME LAPSE AERIAL PHOTO ANALYSIS OF THE CONNECTICUT RIVER FROM 1952 TO 1965,
Massachusetts Univ., Amherst. Dept. of Forestry and Wildlife Management.
William P. MacConnell, and G. Peter Stoll.
Water Resources Bull, Vol 5, No 2, p 37-50, June 1969. 14 p, 9 ref.

Descriptors: *Aerial photography, *Photogrammetry, *Land classification, *Recreation, *Rivers, Land management, Surveys, Land appraisal, Land development, Land resources, Water quality, Streamflow, Floods, New England.
Identifiers: *Connecticut River.

Aerial photogrammetric techniques were developed and tested for identifying and classifying river-based recreation sites. A classification system was designed to describe the nature of the land itself, the land use, or the vegetation on the landscape. The Connecticut, a large river running through four states, was examined and classified using the system. Analysis of two sets of aerial photographs taken with a time lapse of 10 to 13 years enabled determination of past use and development trends. A catalogue of maps classifying strips of land adjacent to the river was prepared and reproduced for use by interested planning agencies. Statistics on land area by types for the river as it now is and as it was 10 to 13 years previously have been prepared by towns, counties, and

states. The aerial photographs proved invaluable for analyzing the recreational potential of the Connecticut River. (Knapp-USGS)
W69-09243

RADIOACTIVE METHODS FOR THE QUANTITATIVE DETERMINATION OF COASTAL DRIFT RATE,
Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette (France).
G. Courtois, and A. Monaco.
Marine Geol, Vol 7, No 3, p 183-206, June 1969. 24 p, 14 fig, 2 tab, 25 ref.

Descriptors: *Sediment transport, *Littoral drift, *Tracers, *Tracking techniques, Radioisotopes, Marking techniques, Sediments, Sands, Radioactivity techniques.
Identifiers: Sediment tracking.

A new method, known as the count rate balance is presented for the quantitative evaluation of coastal drift. It is based on conventional radioactive tracer experiments to which are applied space integration measurements. The count rate balance operation consists of the determination, from the family of isocount curves, of the total number of counts detectable over the radioactive patch as a whole. Once the thickness of the layer in movement is known, the solid displacement rate can be calculated. This method was applied to a radioactive tracer experiment carried out on Apr. 20, 1967 on the Roussillon coast (southwestern France) by immersion of 4.2 kg of natural sediment labelled with 10 Ci of chromium 51 (half-life 27.8 days), at a depth of 4 m between 2 folds in the sea bed. The transport was governed by 2 dominant types of wind and swell conditions. From Apr. 20-29, swells from the north led to a southward displacement of about 1.05 tons/day/linear meter. The method has the advantage of requiring no special equipment apart from that needed in conventional radioactive tracer experiments, and no sampling is necessary. (Knapp-USGS)
W69-09247

RUNS OF PRECIPITATION SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Mathematics and Statistics.
Jose Llamas, and M. M. Siddiqui.
Colo State Univ Hydrol Pap No 33, May 1969. 25 p, 7 fig, 7 tab, 6 ref, 2 append.

Descriptors: *Statistical methods, *Hydrologic data, Data processing, *Analytical techniques, Time series analysis, Statistics, Correlation analysis, Markov processes, Stochastic processes, Probability, Synthetic hydrology, Precipitation (Atmospheric).
Identifiers: Hydrological series analysis.

Three quantitative measures are introduced for the concepts of 'surplus' and 'deficit' in hydrologic series. These are: run-length, run-sum and run-intensity. Positive and negative runs of a series are defined in terms of a fixed value of the variable under consideration, in this case precipitation. The distribution function, moments, and other statistical properties of run-length, run-sum, and run-intensity, are obtained analytically, using two assumptions on the sequence of annual precipitations that it is independent and normally distributed and that it is independent and gamma distributed. For monthly precipitations the series was first standardized as a 2-state Markov chain with stationary transition probabilities. Annual precipitation from 27 stations in Colorado, and monthly precipitation from 219 stations in the Western United States are analyzed. (Knapp-USGS)
W69-09250

A NOTE ON THE EFFECT OF DISPERSION ON MEAN CURRENT MEASUREMENTS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W69-09252

AIRBORNE INFRARED RADIOMETER INVESTIGATION OF WATER SURFACE TEMPERATURE WITH AND WITHOUT AN EVAPORATION-RETARDING MONOMELECULAR LAYER,
Colorado State Univ, Fort Collins. Dept. of Atmospheric Science; and Wave Propagation Lab., Boulder, Colo.
For primary bibliographic entry see Field 03B.
W69-09253

QUATERNARY LAKES OF EASTERN BRAZIL,
Heidelberg Univ. (West Germany). Geological-Paleontological Inst.
For primary bibliographic entry see Field 02H.
W69-09260

PREDICTION OF WATER YIELD IN HIGH MOUNTAIN WATERSHEDS BASED ON PHYSIOGRAPHY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03B.
W69-09293

EVALUATION OF THE CARBON-14 TECHNIQUE FOR MEASUREMENT OF PRIMARY PRODUCTION,
Kaiser Foundation Research Inst., Richmond, Calif. Lab. of Comparative Biology.
M. B. Allen.
Proc 1st Nat Symp on Radioecology, Colorado State Univ, Ft Collins, Sept 10-15, 1961. Radioecology, 1963, Reinhold Pub Corp, NY and Amer Institute of Biological Sciences, Wash, DC, Schultz, Vincent and Klement Jr, Alfred W (Eds), p 477-480. 60 ref.

Descriptors: *Productivity, *Carbon radioisotopes, *Tracers, *Photosynthesis, *Phytoplankton, *Inorganic compounds, *Organic compounds, Light intensity, Light quality, Pigments, Nutrient requirements, Ecology, Sampling, Radioactivity, Carbon dioxide, Algae, Respiration, Chlorophyll.
Identifiers: Chromulina pusilla.

The carbon-14 (C-14) technique of measuring the production of organic material by natural populations is the best method currently available. Its application has stimulated considerable work on the relations between light, photosynthesis, pigmentation, and nutrition--all adding to understanding of phytoplankton ecology. This technique assesses amount of inorganic carbon converted into organic form by the photosynthesis of phytoplankton, almost completely supplanting other assay methods because of its great sensitivity. In this procedure, a prescribed amount of C-14 is introduced into a bottle filled with a water sample, the bottle is incubated, either in situ or in an illuminated incubator, for several hours; the cells are filtered off using a Millipore filter, treated to remove adsorbed or precipitated inorganic carbon, dried, and the C-14 concentration is measured. The problems are discussed in detail together with experiences of earlier investigators. They include, among others, size of samples, conditions for incubation, light screens, temperature, depth, time of day, proper pore size of filters, removal of adsorbed or precipitated inorganic carbon. It seems unlikely that a single correction for respiration covering all phytoplankters in all physiological conditions is possible. (See also Vol 2, No 19, Field 5C, W69-07863). (Jones-Wis)
W69-09333

7C. Evaluation, Processing and Publication

GEO-CHEMICAL CLASSIFICATION OF GROUNDWATER IN THE CARMEL REGION,
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
T. Dicker.
Israel J Earth-Sci, Vol 18, No 2, p 71-81, 1969. 11 p, 3 tab, append.

Descriptors: *Water chemistry, *Water quality, *Hydrogeology, *Groundwater, Solutes, Solubility, Aqueous solutions, Water analysis, Computer programs.
Identifiers: *Israel, Carmel region.

The Carmel region of Israel has an area of 180 sq km and yields about 50 million cu m/yr of groundwater. The chemical composition of the water is highly variable, reflecting the complex geology of the area. A geochemical classification is presented to relate water quality to geology, and the method may have general applicability to all the groundwaters of Israel. A computer program is given to aid in making the large volume of data accessible and to ease the geochemical computation used in classification and mapping. (Knapp-USGS)
W69-09157

METHODOLOGY OF HYDROLOGIC MODEL BUILDING,
Geological Survey, Menlo Park, Calif.
David R. Dawdy, and R. W. Lichty.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 347-355, 1968. 9 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Computer models, *Mathematical models, Digital computers, Computer programs, Streamflow forecasting, Parametric hydrology, Infiltration, Surface-groundwater relationships, Simulation analysis, Optimization.
Identifiers: *Rainfall-runoff models.

Two alternative representations of the infiltration component of a rainfall-runoff simulation model are investigated. Four criteria for choice between the 2 which are considered are accuracy of prediction, simplicity of the model, consistency of parameter estimates, and sensitivity of results to changes in parameter values. Sensitivity plots are presented for obtaining an understanding of interactions in the model by studying several error functions simultaneously. The tools presented are shown to aid in the subjective decisions which must be made in the construction and use of a rainfall-runoff model. (Knapp-USGS)
W69-09182

RAINFALL-RUNOFF MODEL FOR SMALL BASIN FLOOD HYDROGRAPH SIMULATION,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02A.
W69-09183

EXPERIENCES GAINED WITH DIGITAL COMPUTERS IN ANALYZING THE DISCHARGE AND THE RADIUS OF INFLUENCE OF WELLS IN POROUS AQUIFERS,
Design Bureau for Hydraulic Planning, Budapest (Hungary).
For primary bibliographic entry see Field 02F.
W69-09184

SIMULATION OF THE HYDROLOGIC-ECONOMIC FLOW SYSTEM,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
Murland R. Packer, J. Paul Riley, and Eugene K. Israelsen.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 386-391, 1968. 6 p, 4 fig, 7 ref.

Descriptors: *Mathematical models, *Computer models, *Water utilization, Irrigation water, Economics, Model studies, Planning, Optimization, Simulation analysis, Systems analysis, Analog computers, Evapotranspiration, Hydrologic budget, Crop production, Water management (Applied).

Identifiers: Economics of water use.

Increased demands upon available land and water resources have resulted in detailed optimum-use considerations in terms of economic efficiency in water resources planning and management. Effective management of these resources requires an examination of the hydrologic flow system and of the related economic production functions. The electronic analog computer is a valuable computational device which can simulate the hydrologic and economic processes of a total system in water resource planning and development. The various economic hydrologic functions were interrelated by the mass continuity concept, by which it was possible to predict the flow of money and water within the system in terms of their occurrence in space and time. Water values are investigated by directing water to various alternative uses from a particular phase of agriculture. The resulting change in net benefits both to the system as a whole and to individual sectors of the economy are then observed. (Knapp-USGS)
W69-09185

ADAPTION OF ELECTRONIC COMPUTER FOR IMPROVED METHOD OF MODELING SURFACE RUNOFF FROM RAINFALL FOR SMALL WATERSHEDS,
Utah Water Research Lab., Logan. Dept. of Civil Engineering.
Roger A. Amisial, and J. Paul Riley.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 392-404, 1968. 13 p, 7 fig, 4 ref.

Descriptors: *Model studies, *Rainfall-runoff relationships, *Small watersheds, *Analog models, *Arizona, Routing, Streamflow forecasting, Mathematical models, Streamflow, Hydrographs, Synthetic hydrology, Analog computers, Overland flow.
Identifiers: Walnut Gulch (Ariz).

In the field of surface water hydrology, the fundamental equations of motion and continuity adequately portray the overland and channel flow phenomena. The differentail equations, however, are not easily amenable to solution, and their integration in closed form can be obtained only for extremely simplified cases. Techniques of integration by numerical methods have been developed, which can be handled by use of electronic computers. Combined with basic mathematical operations, the electronic analog computer can be successfully employed in the solution of surface runoff models described in terms of the 2 fundamental equations. The watershed is divided into subzones based on topography or physiography. The subzone is simulated by an equivalent rectangular basin transected by the main stream channel. Using the 2 fundamental equations of flow, the water is routed over the basin slopes with the rainfall as input and through the channel system which receives lateral flow from the basin slopes. Models based on the derived equations and on simplified forms of these equations are being developed in an attempt to assess the validity of these equations for some simplifying assumptions made in the usual routing procedures. Tests of the mathematical models are being made by simulating subbasins of the Walnut Gulch Experimental Watershed near Tombstone, Arizona. (Knapp-USGS)
W69-09186

THE USE OF STATISTICAL METHODS FOR SHORT-RANGE FORECASTS,
Hydrometeorological Service of the USSR (Moscow).
For primary bibliographic entry see Field 02E.
W69-09187

PROBLEMS IN SIMULATING AND EVALUATING VARIOUS METHODS OF LINEAR FLOOD ROUTING USING A SMALL DIGITAL COMPUTER,
University Coll., Cork (Ireland).
B. M. Harley, and J. C. I. Dooge.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 417-425, 1968. 9 p, 1 fig, 4 ref.

Descriptors: *Routing, *Mathematical models, *Computer programs, Digital computers, Linear programming, Flood routing, Flood forecasting, Synthetic hydrology, Data processing.
Identifiers: Flood routing model.

An IBM 1620 computer with 40 K storage and an on-line IBM 1311 disc unit was used to compute the complete linear solution for flood routing in a uniform open channel, to simulate this solution by a number of 2-parameter models, and a number of 3-parameter models, and to evaluate the errors of simulation. Sixteen individual programs were developed and then combined into a program system capable of operating a number of specified sequences of programs on a single input loading. (Knapp-USGS)
W69-09188

SYNTHESIS OF SEQUENCES OF SUMMER THUNDERSTORMS VOLUMES FOR THE ATTERBURY WATERSHED IN THE TUCSON AREA,
Arizona Univ., Tucson. Office of Hydrology and Water Resources.
For primary bibliographic entry see Field 02B.
W69-09190

PRINCIPLES OF MODELLING AND PROSPECTS OF USING ELECTRONIC COMPUTERS IN HYDROLOGICAL FORECASTING,
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 06A.
W69-09191

STUDY OF THE NUMERIC CALCULATIONS OF THE PROPAGATION OF FLOODS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
For primary bibliographic entry see Field 02E.
W69-09192

A DATA COLLECTION AND STORAGE SYSTEM USING A DIGITAL EVENT RECORDER,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
M. J. Goodspeed.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 473-484, 1968. 12 p, 9 fig, 11 ref.

Descriptors: *Data collections, *Hydrologic data, *Data transmission, *Data processing, *Data storage and retrieval, Instrumentation, Computers, Digital computers, Measurement, Gaging stations, Gages, Telemetry.
Identifiers: Australia, Data recorders, Digital recorders.

A multichannel digital event recorder records rainfall, stage, well water level, temperature, wind, or combined data directly on computer compatible papertape and is designed for unattended operation remote from power supplies for periods up to one year. On input to a digital computer, data are converted to magnetic-tape files in a standard, condensed format. Routine abstract tabulations and more involved analyses can then be undertaken. The recorder is battery powered, and recharged by solar cells. (Knapp-USGS)
W69-09193

COMPUTER SIMULATION OF REMOTE SENSING BY MICROWAVE RADIOMETERS,
Ryan Aeronautical Co., San Diego, Calif.
E. Dedman, J. Culver, and F. Janza.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 485-497, 1968. 13 p, 4 fig.

Descriptors: *Remote sensing, *Model studies, *Simulation analysis, Mathematical models, Analog models, Digital computers, Systems analysis, Operations research.
Identifiers: *Microwave radiometers, Radiometry.

A computer simulation of airborne microwave radiometers as remote sensors for mapping thermal upwellings in the ocean is described. The importance of correlating 'ground truth' data to radiometer brightness temperature for deriving and validating mathematical models is pointed out. Methods of studying system characteristics using simulations are proposed and the value of such studies in reducing the cost of expensive field testing is emphasized. The benefits in utilizing analogous experience gained in the development of large space systems in evaluating remote sensing for hydrology are enumerated and specific analogies discussed. (Knapp-USGS)
W69-09194

USE OF DIGITAL COMPUTERS IN INTERNATIONAL WATER RESOURCES INVESTIGATIONS,
Food and Agriculture Organization of the United Nations, Rome (Italy).
R. G. Thomas.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 531-534, 1968. 4 p.

Descriptors: *Water resources development, *Planning, *Digital computers, *Model studies, Optimization, Economics, Data processing, Water management (Applied), Investment, Investigations.
Identifiers: United Nations.

A summary is presented of the use of digital computers for water resource projects in several countries. These projects are conducted by the Food and Agriculture Organization of the United Nations, funded by the United Nations Development Program. The difficulties which must be overcome include allocation of budget, location of computer near project area, training of United Nations personnel, and training of government counterpart personnel. Training is currently being carried out in field projects through use of short term consultants. Use of computers in water resource studies in less developed countries can provide better answers in order to minimize the risks of poorly considered capital investments. (Knapp-USGS)
W69-09195

COMPREHENSIVE INFORMATION RETRIEVAL IN THE FIELD OF WATER RESOURCES,
American Water Resources Association, Urbana, Ill.
For primary bibliographic entry see Field 10.
W69-09244

ANALYSIS OF SERIALS RELATED TO WATER RESOURCES,
Wolf Research and Development Corp., Riverdale, Md. Dept. of Special Studies.
For primary bibliographic entry see Field 10.
W69-09258

GENERATION OF FITTING PROBABILITY DISTRIBUTION FUNCTIONS OF DISCHARGES BY ELECTRONIC COMPUTER,
Research Inst. for Water Resources Development, Budapest (Hungary); and Eotvos Lorand Univ., Budapest (Hungary). Dept. of Theory of Probability.
M. Domokos, and D. Szasz.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci

Hydrol, Publ No 81, p 535-545, 1968. 11 p, 4 fig, 4 ref.

Descriptors: *Streamflow forecasting, *Mathematical models, *Digital computers, Probability, Statistical methods, Optimization, Regression analysis, Computer programs, Data processing, Water management (Applied), Hydrologic budget, Water balance, Hydrograph analysis.
Identifiers: *Hungary.

Water resources management requires a large amount of calculation of probability distribution functions of daily discharges. The normal, the logarithmic-normal and the gamma distributions were studied. Parameters of the distribution functions were estimated by the maximum likelihood method. Some details of the solution achieved by electronic computer include the ranging of sample elements according to order of magnitude, the computation of some parameters through solving an implicit system of equations by iteration, and some problems of the performance of the chi-squared test. Probability distribution functions of stream discharges were studied in the interest of water resources management in Hungary. (Knapp-USGS)
W69-09268

ON A PROBLEM OF FIXATION OF RESERVOIR CAPACITY SOLVED WITH THE HELP OF ELECTRONIC COMPUTER,
Central Water and Power Commission, New Delhi (India).
R. Rangarajan.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 546-554, 1968. 10 p, 4 fig, 4 ref, 1 append.

Descriptors: *Water management (Applied), *Reservoir design, *Data processing, *Digital computers, Computer programs, Estimating, Optimization, Reservoir operation, Streamflow forecasting, Water control.
Identifiers: *India.

An analytical approach based on the theory of dams by Moran is presented for developing a set of general curves relating storage capacity to the annual draft. The variables involved are expressed in standardized form so that the curves can be of general applicability. The annual inflow variable (or its known transform) is assumed to be normally distributed. Assuming the standardized inflow variable to take discrete values over the whole range, the probabilities of reservoir content before utilization are calculated for relevant combination pairs of capacity and annual draft. The process involved framing of sets of simulaneous equations of varying number of unknowns for different pairs of capacity and draft, and working out their solutions. The procedure, which is quite involved, could be easily run through an Electronic Computer. An idea of the general computer program in Fortran II prepared for the IBM 1620 Electronic Computer is also given. (Knapp-U SGS)
W69-09269

COMPUTER DOCUMENTATION AND RETRIEVAL OF HYDROLOGIC INFORMATION FOR SMALL RESEARCH GROUPS OR INDIVIDUALS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 10.
W69-09270

DIGITAL COMPUTER APPLICATIONS THAT FACILITATE COLLECTION AND INTERPRETATION OF GROUNDWATER DATA,
Geological Survey, Lawrence, Kans.
Jesse M. McNellis, Charles O. Morgan, and Brent H. Lowell.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 561-568, 1968. 8 p, 6 fig, 7 ref.

Descriptors: *Computer programs, *Data processing, *Data storage and retrieval, *Data collections, Hydrologic data, Surveys, Mapping, Contours, Distribution patterns, Hydrography, Profiles, Gaging stations, Investigations.
Identifiers: US Geological Survey.

Well-inventory, water-quality, lithologic-log, and water-level data are basic to groundwater studies. Computer programs designed to facilitate the collection and processing of these data are coordinated with and are complementary to the design and implementation of coding forms, manuals, and systems. Digital computer programs developed in the Kansas District of the Water Resources Division, U.S. Geological Survey that materially aid hydrologists in field work include: checking, tabulation, standard analysis, and mapping or graphic-plot routines. Quality control of data is obtained by proofing computer output from checking and tabulation programs against source documents, so that errors infrequently occur in the results of subsequent programs. A hydrologist, with the assistance of frequently-updated computer output, can schedule field work more efficiently. The work plan can be selectively modified throughout the period that the hydrologist is engaged in relatively short test-drilling, well-inventory, or water-sampling phases of a project. The flexibility in scheduling and modifying field work obtained through usage of computer programs facilitates collection of groundwater data. This flexibility provides for better utilization of time, money, personnel, and equipment. (Knapp-USGS)
W69-09271

A DIMENSIONLESS REPRESENTATION OF FLOOD WAVE SUBSIDENCE BY MEANS OF A SUBSIDENCE FUNCTION,
Netherlands, Rijkswaterstaat.
For primary bibliographic entry see Field 02E.
W69-09272

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
M. J. Burley, and J. A. Cole.
Symp of Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 584-590, 1968. 7 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Reservoir operation, *Water management (Applied), *Computers, Dynamic programming, Digi tal computers, Optimization, Desalination, Economics, Routing, Estimating, Conjunctive use, Regression analysis, Water demand, Time series analysis, Costs.
Identifiers: Linked reservoir systems.

Month-by-month control rules were formulated by digital computer for a pair of reservoirs meeting a common demand and for a single reservoir worked jointly wi th a seawater desalination plant. A dynamic programming approach was based on inflow probabilities, and allowed for 64 possible combi nations of reservoir contents and preceding inflows. A search of 34 years of inflows was used to find a 'worst case' basis for deciding at what reservoir contents the desalination plant should start to operate. By adopting the control rule it was shown that the linked system reduced operating costs by 30 to 50% below those of a year-round supply by desalination. (Knapp-USGS)
W69-09273

A COMPUTER PROGRAM FOR ESTIMATING REGRESSIONS BETWEEN TIME SERIES,
Water Research Association, Medmenham (England).
R. T. Clarke.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 591-597, 1968. 7 p, 1 tab, 8 ref.

Descriptors: *Statistical methods, *Computer programs, *Time series analysis, *Regression analysis, Correlation analysis, Charts, Estimating, Uniformity coefficient.
Identifiers: Statistical calculation program.

A computer program for time-series analysis which computes and graphs the spectrum of each series, the cospectrum, the quadrature spectrum and the coherence is described. An extension of the program may be used for multiple regression analysis. The use of the program in study of hydrological time series is discussed. (Knapp-USGS)
W69-09274

EVALUATION OF DROUGHT PERIODS BY COMPUTER ANALYSIS: AN APPLICATION IN SOUTHERN ITALY,
State Hydrographic Service, Genoa (Italy); and Rari Univ. (Italy).
Samuele Cavazza, and Stefano Vannella.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 598-603, 1968. 6 p, 4 fig.

Descriptors: *Synoptic analysis, *Droughts, *Mathematical studies, *Digital computers, Climatology, Duration curves, Mapping, Contours, Depth-area-duration analysis, Rainfall, Evapotranspiration, Evaluation.
Identifiers: *Italy, Drought analysis.

Problems arising in analysis of daily rainfall values and frequency of rainy days are discussed and their interest for agriculture is emphasized. Methods and examples are given to study the change of drought-spell duration throughout the year, taking different totals of precipitations up to 50 mm as limit values for drought. Regional maps of drought duration are shown. Distribution frequency is illustrated. Periodic components for the time series of drought duration values for a particular case are shown and their meaning is discussed. (Knapp-USGS)
W69-09275

HYBRID COMPUTER SIMULATION OF A LOW-FLOW AUGMENTATION SUBSURFACE STORAGE SYSTEM,
R. M. Shane, G. Mavrigian, and H. J. Day.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 604-609, 1968. 6 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Model studies, *Computer models, *Analog computers, *Digital computers, *Low-flow augmentation, Conjunctive use, Groundwater, Water storage, Surface-groundwater relationships, Artificial recharge, Aquifers, Glacial drift, Sands, Gravels, Water management (Applied), Water supply, Water utilization.
Identifiers: *Miami River (Ohio), Hybrid computer model.

A hybrid computer program is described which has been developed to simulate the performance of a subsurface storage system used for low-flow augmentation of the Miami River (Ohio, U.S.A.). The simulator is used as part of a Monte Carlo procedure to compute probabilities and expected values useful for evaluating the cost of the operation and the risk of a functional failure. The analog program is based on a discrete space-continuous time (DSCT) approximation to the non-linear partial differential equations of groundwater flow in an unconfined aquifer obtained from an application of Darcy's law and the principle of conservation of mass. Synthetic streamflows are generated using pseudo-random numbers on the digital computer. (Knapp-USGS)
W69-09276

MODELLING OF HYDROLOGIC PROCESSES WITH THE AID OF ELECTRONIC COMPUTERS,
Hydrometeorological Centre, Moscow (USSR).
For primary bibliographic entry see Field 02A.
W69-09277

NUMERICAL SOLUTIONS OF THE NAVIER STOKES EQUATION FOR FLOW THROUGH IDEALIZED POROUS MATERIALS,
University Coll. of Townsville (Australia). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W69-09278

APPLICATION OF STATISTIC METHODS FOR SOLUTION OF STEADY AND UNSTEADY GROUNDWATER FLOW,
V. Halek, and M. Novak.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 724-737, 1968. 14 p, 3 fig, 12 ref.

Descriptors: *Statistical models, *Groundwater movement, *Unsteady flow, *Computer models, Digital computers, Monte Carlo method, Statistical methods, Probability, Synthetic hydrology, Porosity, Permeability, Elasticity.
Identifiers: Statistical hydrology.

A mathematical model is developed of plane groundwater flow in a deformable elastic medium under free water surface conditions. Linearized equations are used to describe unsteady flow and boundary conditions. A Monte Carlo method is used to describe water movement statistically. (Knapp-USGS)
W69-09279

SELF-SIMILAR SYNTHETIC HYDROLOGY,
IBM Watson Research Center, Yorktown Heights, N. Y.
J. R. Wallis, and B. B. Mandelbrot.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 738-755, 1968. 18 p, 15 fig, 2 tab, 19 ref.

Descriptors: *Statistical models, *Synthetic hydrology, Markov processes, Monte Carlo method, Frequency analysis, Time series analysis, Correlation analysis, Regression analysis.
Identifiers: Self-similar statistical processes.

Appropriately chosen self-similar random processes provide much better fits to historical hydrological records than the current Markovian models. The experimental findings of Harold Edwin Hurst on the range of white noise are full accounted for by such self-similar models. As a result, one may expect 'self-similar synthetic hydrology' to be better than Markovian models. Some of the evidence is outlined and a sampling of the simulation results obtained thus far are briefly presented. (Knapp-USGS)
W69-09280

08. ENGINEERING WORKS

8A. Structures

COOLING POND DESIGN IN THE SOUTHWEST,
Ebasco Services, Inc., New York.
For primary bibliographic entry see Field 05B.
W69-09031

NATURAL DRAUGHT COOLING TOWERS - FERRYBRIDGE AND AFTER,
Institution of Civil Engineers, London (England).
For primary bibliographic entry see Field 05D.
W69-09041

AERODYNAMIC IMPLICATIONS OF THE FERRYBRIDGE RESEARCH INVESTIGATIONS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 05D.
W69-09042

THE PROBLEMS OF ESTIMATING WIND LOADING ON STRUCTURES WITH SPECIAL REFERENCE TO COOLING TOWERS,
National Physical Lab., Teddington (England). Aerodynamics Div.
C. Scruton.
IN Natural Draught Cooli ng Towers - Ferrybridge and After, The Institution of Civil Engineers, p 85-89, 1967. 5 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Cooling towers, *Structural design, *Model studies, Flow separation, Design criteria, Reynolds number, Wind velocity, Simulation analysis.
Identifiers: Pressure coefficient, Shape coefficient, *Wind-loading, *Ferrybridge, Code of practice, Wind tunnel.

The problem of estimating design wind forces and pressures on buildings and structures is divided into assessments of (a) the design wind speed, and (b) the shape and pressure coefficients. A considerable degree of uncertainty exists in the estimates of both the design wind speeds and the coefficients. A method for obtaining design wind speeds is described which is based on Shellard's maps showing the distribution of the maximum mean hourly wind speed at height 33 ft over the United Kingdom, and a simple procedure is given for converting these speeds to refer to gust speeds for shorter durations and to other heights. Maximum gust speeds averages over 10s and the extreme gust (less than 3s (seconds)) are recommended respectively for the consideration of stability and for the local pressures on cladding. For many structures the design demands more detailed and specific wind-loading data than are given in Codes. Consideration is given to the conditions under which wind-tunnel tests are conducted. Practical modeling difficulties lead to some uncertainty in extrapolating test results to full-scale towers. (Sherman-Vanderbilt)
W69-09055

SUPERVISION OF DAMS AND RESERVOIRS.
For primary bibliographic entry see Field 06E.
W69-09077

WIND RECORDS AND THEIR APPLICATION TO STRUCTURAL DESIGN,
British Meteorological Office, Bracknell (England).
H. C. Shell ard.
Natural Draught Cooling Towers-Ferrybridge and After, Proceedings of the conference held at the Institution of Civil Engineers (June 12, 1967), p 67-72, 1967. 1 fig, 1 tab, 16 ref.

Descriptors: *Wind pressure, Wind velocity, Flow profile, Frequency analysis, Structural design.
Identifiers: *Wind records, Topographic effects on winds, United Kingdom, Anemograph.

The nature of the continuous wind records that are maintained in the U.K. and the distribution of the stations providing such records to the Meteorological Office are described. The method of routine analysis of the records is indicated. For structural design purposes only the strongest winds are relevant and the statistical method used to analyze the annual extremes in order to obtain estimates of the probable maximum speeds likely to be exceeded only once in 50 or 100 years is outlined. Other important aspects affecting the choice of design speed for a structure are the variation of speed with height above the ground, the relationship between maximum speed and averaging time and the effects of ground roughness and topography. Current practices for dealing with these are described, indicating their background and what is being done to overcome certain limitations. (Ross-Vanderbilt)
W69-09309

COOLING TOWERS: STEP-CHILDREN OF INDUSTRY,
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
James Willa.
Heating, Piping and Air Conditioning, Vol 38, No 1, p 153-158, Jan 1966. 9 fig.

Descriptors: *Thermal pollution, *Cooling towers, *Maintenance, *Application methods, *Fungicides, *Thermal capacity, Chemical wastes, Distribution, Heat transfer.
Identifiers: *Polychlorophenate, *Delignification, *Soft rot, *White pocket rot, Plenum.

Regular and thorough maintenance of cooling towers is discussed, and an effective, safe, and economical method of spraying fungicides into plenum areas is recommended. The maintenance problems are recognized as pollution (chemicals in treatment), labor, safety, and economics. In a plant, the types of wood attack known are: delignification, (chemical), biological surface attack and internal fungus attack. The thermal capability of a tower can be seriously affected by minor neglect because it depends on the tower's distribution characteristics, or a constant ratio of water to air throughout the tower. The treatment involves assuring a pH of between 6.0 and 7.0 and applying a monoxidizing algaecide-fungicide and a chromate residual. A method of applying polychlorophenates directly in plenum areas has been developed. Economic considerations and equipment needs for these methods are presented. (Sherman-Vanderbilt)
W69-09312

WHAT LESSONS FROM FERRYBRIDGE.

Engineering, Vol 202, p 339-402, Sept 2, 1966. 6 fig.

Descriptors: *Cooling towers, *Failures, *Design criteria, *Structural engineering, *Structural stability, *Tensile stress, *Vibrations, *Reynolds number, Wind velocity, Pressure head, Model studies.
Identifiers: *Ferrybridge power plant, *Wind loading, Wind fluctuation, Wind tunnel experiments.

This article reports the technical factors of failure at the Ferrybridge power plant. Evidence from the collapse, eyewitness accounts and a later steeplejack inspection are considered. Although wind speeds did not reach the theoretical limit, the plant construction required an extrapolation of the structural dimensions, affecting its wind resistance capabilities. Furthermore, the validity of the wind loading data is questioned. The following recommendations are made for a more thorough study of the philosophy of cooling tower design including: (1) Design wind speeds and their conversion into wind pressures, (2) Factors accounting for grouping effects and fluctuating loads, (3) Factors accounting for structural considerations other than those mentioned, (4) Material strength characteristics for concrete and steel reinforcement. Specific studies of wind stress on cooling towers should be pursued intensively. There is a need for more data on gust characteristics. Wind loading should be specified more carefully or in simple functional terms, never as a dual specification. Meteorological data on t he probable maximum ten second average wind speed for a fifty year period is recommended to the designer. Research and development data should be immediately accessible to consultants and contractors. (Sherman-Vanderbilt)
W69-09313

HYPERBOLIC COOLING TOWERS WITH RESERVOIR STORAGE OF MAKEUP TO

SERVE THE PROPOSED KEYSTONE GENERATING STATION,
Gilbert Associates, Inc., Reading, Pa., and Pennsylvania Electric Co., Johnstown.
For primary bibliographic entry see Field 05D.
W69-09318

8B. Hydraulics

LAMINAR DISPERSION IN DIVERGING CHANNELS AND IN CONCENTRIC ANNULI,
Clarkson Coll. of Technology, Potsdam, N.Y.
William N. Gill, Ulku Guceri, and Richard J. Nunge.
Office of Saline Water Res and Develop Progr Rep No 443, June 1969. 37 p, 10 fig, 1 tab, 24 ref. OSW Grant No 14-01-0001-1096.

Descriptors: *Open channel flow, *Dispersion, Laminar flow, Convection, Hydraulics, Diffusion, Mixing, Model studies, Mathematical models.
Identifiers: Diverging channel flow, Peclet number, Annular channel flow.

Dispersion in flow in diverging channels, where the velocity decreases with axial distance is studied. Numerical experiments indicate that at sufficiently large values of the angle of divergence and Peclet number, both axial and transverse molecular diffusion play a minor role in the dispersion process and the system is dominated by convection. This is in marked contrast to parallel wall systems. A dispersion model was developed for such flows for limited ranges of the Peclet number and angle of divergence. At sufficiently large values of dimensionless time the dependence of concentration on both axial position and time can be represented by a single similarity coordinate. This behavior is predicted by both numerical solutions of flow equations and analytical solutions of the dispersion model. Dispersion in concentric annuli was considered also and an explicit expression for the dispersion coefficient was derived from first principles. (Knapp-USGS)
W69-09246

8C. Hydraulic Machinery

HYDRAULICS OF CIRCULATING SYSTEMS,
Tennessee Valley Authority, Knoxville.
Clifton W. Bolieau.
Journal of the Power Division, Proceedings of the ASCE, Vol 85, No PO1, p 1-22, February 1959. 4 fig, 2 tab, 5 ref.

Descriptors: *Tennessee Valley Authority Project, *Hydraulic engineering, *Hydraulic design, *Condensers, *Cooling water, Pump testing, Repairing, Pumping plants, Water level fluctuations, Valves, Slime, Conduits.
Identifiers: *Circulating water system, Vacuum system.

This paper discusses the factors entering into the design of condenser circulating water systems, with particular reference to those in the TVA project. These factors include determination of design flow, pump selection and setting, waterway design, air accumulation and removal, pump testing, and system operation. The TVA systems vary according to size, steam conditions, terrain, construction cost, value of power, quality and quantity of cooling water, water level fluctuations and others, so individual computations and structural decisions are made. The data is reported for each plant although the figures show typical structures. The design is discussed in terms of the most efficient operational principles and of materials and cost. Specific details are given for numerous design decisions encountered in the TVA system. (Sherman-Vanderbilt)
W69-09319

ROCKY MOUNTAIN POWER CO V FEDERAL POWER COMM'N (FEASIBILITY INFORMATION REQUIRED BEFORE AUTHORIZATION OF POWER PLANT).
For primary bibliographic entry see Field 06E.
W69-09406

OPEN-CHANNEL TRANSITIONS IN SUPERCRITICAL FLOW,
Pennsylvania State Univ., University Park, Coll. of Engineering.
F. L. Blue, Jr., and H. Y. Rajagopal.
Engineering Research Bulletin B-98, April 1969. 85 p, 10 tab, 66 fig, 4 append. Available for $3.00 a copy from Engineering Publications, Hammond Bldg, Penn State Univ, University Park. 16802.

Descriptors: *Open channels, *Supercritical flow, *Transition flow, *Froude number, Channel flow, Water flow, Upstream, Downstream, Walls, Engineering structures, Uniform flow.
Identifiers: *Centerline, *Rectangular channel, *Trapezoidal channel, Wave patterns.

Transitions of three different shapes were tested for Froude numbers varying from 1.2 to 3.2, representing test flows of 0.57 to 4.47 cubic feet per second (cfs). Each transition connected an upstream rectangular channel with a downstream trapezoidal channel, all three parts lying on one straight centerline. One transition had warped walls. The other two effected the transitions with plane walls: one with a vertical surface above a sloping surface, the other with a sloping surface above a vertical one. The experiments with each of the three shapes covered combinations of five transition lengths with three depths in the rectangular approach channels. Thirty-one different transitions were investigated for the case of constant and continuous invert slopes equal to the rectangular channel slope for uniform flow. Graphs summarize the variation of the water surface along the channel walls and centerline, caused by the wave patterns of supercritical flow. These graphs indicate the complex wave patterns, and they are also a basis for designing transitions of the three shapes tested. A guide is offered for application of the extensive data to actual design. (Sink-Penn State Univ)
W69-09445

8H. Rapid Excavation

WOLF CREEK COLLIERIES CO V DAVIS (DAMAGE TO WATER WELL BY BLASTING OPERATIONS).
For primary bibliographic entry see Field 06E.
W69-09433

8I. Fisheries Engineering

FISH AND FISHERIES.
For primary bibliographic entry see Field 06E.
W69-09079

ATLANTIC STATES MARINE FISHERIES COMPACT.
For primary bibliographic entry see Field 06E.
W69-09080

ATLANTIC STATES MARINE FISHERIES COMPACT.
For primary bibliographic entry see Field 06E.
W69-09087

CONSERVATION--FISHING IN CERTAIN WATERS.
For primary bibliographic entry see Field 06E.
W69-09088

METHOD AND MANNER OF TAKING FISH.

NH Rev Stat Ann secs 211:1-211:17-C (1964), as amended, (Supp 1967).

Descriptors: *New Hampshire, *Fishing, *Fishing gear, *Fish, Fish conservation, Fish harvest, Fish establishment, Fish populations, Fish management, Fish types, Sport fish, Sport fishing, Water sports, Recreation, Ice, Regulation, Legislation, Legal aspects, Hunting, Bodies of water, Ice fishing, Iced lakes, Permits, Lakes, Rivers, Streams, Trout, Salmon, Carp, Fly fishing, Bait fishing, Baits, Ponds, Seasonal, Explosives, Poisons, Obstruction to flow Weirs, Outlets, Inlets (Waterways), Nets, Dams, Gates, Water levels, Fry, Fertilizers, Smelts, Interstate rivers.
Identifiers: Penalties (Civil), Bobhouse, Horned pouts.

The method and manner of taking fish in the public waters of New Hampshire is specifically regulated. Use of nets and bow and arrow to take fish or bait is restricted to certain species. Use of explosives, obstructions to fish passage, water taps, spears, jacklights, and other such devices and methods to take fish is prohibited. Only bait and fly fishing is permitted in certain waters. Ice fishing and use of bob houses is restricted to certain waters and subject to specific regulations. Only certain types of fish may be legally used as live bait. Licensed fishermen of each respective state shall have reciprocal fishing rights upon interstate lakes, ponds and rivers. (Carruthers-Fla)
W69-09108

REGULATIONS IN COUNTY WATERS.
For primary bibliographic entry see Field 06E.
W69-09391

CRABS, LOBSTER AND TERRAPINS.
For primary bibliographic entry see Field 06E.
W69-09392

OPEN SEASONS FOR, LIMITS FOR, AND METHODS OF TAKING CERTAIN WATER LIFE.
For primary bibliographic entry see Field 06E.
W69-09403

PRIVATE FISH HATCHERY.
For primary bibliographic entry see Field 06E.
W69-09443

10. SCIENTIFIC AND TECHNICAL INFORMATION

COMPREHENSIVE INFORMATION RETRIEVAL IN THE FIELD OF WATER RESOURCES,
American Water Resources Association, Urbana, Ill.
Icko Iben.
Water Resources Bull, Vol 5, No 2, p 51-58, June 1969. 8 p, 7 ref.

Descriptors: *Reviews, *Bibliographies, *Water resources, *Data storage and retrieval, *Information retrieval, Documentation, Data collections, Publications, Water resources development, Research and development, Data processing, Digital computers, Data transmission.
Identifiers: Bibliography of current awareness, *Water resources literature, Current awareness programs, American Water Resources Association.

The ages-old and ever-growing need for communication and information retrieval among scientists has found expression in the development of indexes, abstracts, reviews and combinations or variations of such. A short review of such efforts is followed by a discussion of efforts along these lines in the new field of water resources science and technology. Such undertakings as the Information Retrieval System of the American Society of Civil Engineers and of the U.S. Water Resources Research Office are compared with that of the American Water Resources Association. (Knapp-USGS)
W69-09244

NALYSIS OF SERIALS RELATED TO WATER ESOURCES,
/olf Research and Development Corp., Riverdale, ld. Dept. of Special Studies.
/alter F. Johanningsmeier, Robert E. Frye, and obert F. Nasal.
B 185 706 available from the Clearinghouse for 3.00 in paper copy or 0.65 in microfiche. Wolf es and Develop Corp Rep, Mar 1969. 135 p, 1 fig, 1 tab, 29 ref, 11 append. OWRR Contract no 14-1-0001-1610.

escriptors: *Publications, *Water resources, Surveys, *Reviews, *Bibliographies, Libraries, ocumentation, Information retrieval, Data orage and retriev al, Data transmission, Libraries, bstracts, Classification.
lentifiers: Survey of Water Resources Publica-ons.

total of 1964 serial titles with probable relevance the field of water resources were identified. pecimen issues of approximately 900 serials were cated in Washington, D. C. area libraries. Of ese, 867 serials were found to satisfy the subject and serial criteria developed for this study and were analyzed in depth. Selected information on each serial was recorded individually on a data sheet developed specifically for this project in conjunction with the staff of the Water Resources Scientific Information Center. In addition, a data file system providing for storage, maintenance, and retrieval of data on each serial was designed and put into service. Some of the current characteristics of water resources serials are discussed with particular emphasis on primary scientific or technical serials. Recommendations, based upon the findings of the study, are made for the inclusion of additional serials in the data file system. (Knapp-USGS)
W69-09258

COMPUTER DOCUMENTATION AND RETRIEVAL OF HYDROLOGIC INFORMATION FOR SMALL RESEARCH GROUPS OR INDIVIDUALS,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Henry W. Anderson, and Theodor B. Yerke.
Symp on Use of Analog and Digital Computers in Hydrol, Tucson, Ariz, Dec 1968, Vol 2, Int Ass Sci Hydrol, Publ No 81, p 555-560, 1968. 6 p, 1 tab, 31 ref.

Descriptors: *Information retrieval, *Documentation, *Data storage and retrieval, *Data processing, *Computer programs, Digital computers, Bibliographies, Classification, Editing, Publications, Reviews, Abstracts, Data collections.
Identifiers: Small-operation data systems.

The development of computer-based information handling systems designed to give direct support to the documentation and retrieval needs of individual researchers has received scant at tention. The difference between personal-use systems and large, library-oriented systems is not well understood. The U.S. Forest Service has developed a personal documentation system (FAMULUS) which 'automates' a personal file and provides updating, editing, vocabulary-building, and searching capabilities. Use of FAMULUS in preparing a summary of sedimentation research in the United States is illustrated. (Knapp-USGS)
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